UNITED STATES OF AMERICA:
WAR DEPARTMENT.

MONTHLY WEATHER REVIEW.

(GENERAL WEATHER SERVICE OF THE UNITED STATES.)

NOVEMBER, 1887.

CONTENTS.

PREPARED UNDER THE DIRECTION OF
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1ST LIEUTENANT, 4TH ARTILLERY, A. S. O. AND ASSISTANT.

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SIGNAL OFFICE.
1888.

List of merchant marine steam and sailing vessels from which International Simultaneous Meteorological reports were received at the Office of the Chief Signal Officer, U. S. Army, Washington, D. C., in time to be used in the preparation of the Weather Review for the month of November, 1887.

	Name of vessel.	Captain.
	Allan Line.	
Br.	s. s. Buenos Ayrean	Capt. J. Scott.
	Grecian	C. E. Le Gallias.
	Hibernian	J. Brown.
	Manitoban	Wm. Dunlap.
	Sarmatian	W. Richardson.
	Scandinavian	John Park.
	Siberian	R. P. Moore.
	American Line.	
Br.	s. s. British King	John Kelly.
	British Prince	S. Nowell.
	British Princess	E. H. Freeth.
Am.	Indiana	W. J. Boggs.
	Lord Clive	F. Urquhart.
Br.	Lord Gough	E. M. Hughes.
	Anchor Line.	
Br.	s. s. Alsatia	J. Brown.
	Anchoria	W. Brown.
	Circassia	A. Campbell.
	Columbia	Thos. Mitchell.
	Devonia	W. G. Crockhart.
	Dorian	J. McKeague.
	Ethiopia	John Wilson.
	Furnessia	J. Hedderwick.
	India	John Jameson.
	Olympia	L. Swain.
	Sidonian	B. Jamieson.
	Atlas Line.	
Br.	s. s. Ailsa	J. W. Sanson.
	Alana	E. J. Seiders.
	Arena	F. McKay.
	Alvo	D. Williams.
	Athos	H. Low.
	Atlas	J. W. Tobin.
	Claribel	J. Evans.
	Booth's S. S. Co. (limited).	
Br.	s. s. Ambrose	E. Bisson.
	Bordeaux Steam Navigation Co.	
Fr.	s. s. Chateau Lafite	C. Ollivier.
	Chateau Yquem	C. F. Journeil.
	Bristol-City Line.	
Br.	s. s. Brooklyn City	W. Fitt.
	Canada Shipping Company.	
Br.	s. s. Lake Superior	Wm. Stewart.
	Cromwell Line.	
Am.	s. s. Hudson	H. R. Freeman.
	Louisiana	E. V. Gager.
	New Orleans	T. P. C. Halsey.
	Clyde Line.	
Am.	s. s. Yemassee	1st Off. J. C. Norton.
	Cunard Line.	
Br.	s. s. Aurania	Capt. W. H. P. Haines.
	Cephalonia	Henry Walker.
	Etruria	T. Cook.
	Pavonia	A. McKay.
	Servia	H. McKay.
	Umbria	W. McMickan.
	Fabre Line.	
Fr.	s. s. Neustria	P. Verries.
	Furness Line.	
Br.	s. s. British Crown	A Smith.
	General Trans-Atlantic Steamship Co.	
Fr.	s. s. La Bourgogne	E. Franguel.
	La Bretagne	M. de'Jousselin.
	La Champagne	E. Traub
	La Gascogne	C. Santelli.
	La Normandie	G. de Kersabiec.
	Great Western S. S. Line.	
Br.	s. s. Dorset	Ch. Off. E. Crossman.
	Warwick	Capt. L. Morice.
	Guion Line.	
Br.	s. s. Arizona	S. Brooks.
	Nevada	J. Douglas.
	Wisconsin	E. Bentley.
	Wyoming	C. L. Rigby.
	Hamburg-American Line.	
Ger.	s. s. Gothia	H. Bauer.
	Lessing	H. Barends.
	Moravia	O. Pesoldt.
	Rhaetia	H. Vogelgesang.
	Rugia	C. Kordell.
	Slavonia	H. Schmidt.
	Suevia	C. Ludwig.
	Wieland	A. Albers.
	Inman Line.	
Br.	s. s. City of Chester	A. Lewis.
	City of Chicago	Fred Watkins.
	City of Richmond	A. Redford.
Am.	s. s. Ohio	R. W. Sargent.
	Pennsylvania	A. B. Thomas.
	Johnston Line.	
Br.	s. s. Baltimore	J. Treanery.
	Nessmore	Geo. Elliott.
	Lamport & Holt's Steamship Company.	
Br.	s. s. Bessel	C. J. Watson.
	Herschel	Ch. Off. M. Sieders.
	Olbers	Capt. James Clarke.
	Nasmyth	Thos. T. Farrell.
	Leyland Line.	
Br.	s. s. Bavarian	Robt. Leask.

	Name of vessel.	Captain.
	Leyland Line—Continued.	
	Bulgarian	Capt. E. Parry.
	Istrian	T. H. Fox.
	Virginian	M. Fitt.
	Mallory Line.	
Am.	s. s. Alamo	Samuel Risk.
	City of San Antonio	J. Wilder.
	Colorado	J. Daniel.
	Lampasas	M. B. Crowell.
	Nueces	J. Bolger.
	Rio Grande	Jas. F. Lewis.
	State of Texas	Gilbert Williams.
	Mediterranean and New York S. S. Co.	
Br.	s. s. Ponca	W. Bowen.
	Pontiac	H. W. Brown.
	Mississippi & Dominion Steamship Co.	
	Sarnia	Jos. Gibson.
Br.	s. s. Vancouver	C. J. Lindall.
	Morgan Line.	
Am.	s. s. Eureka	R. B. Quick.
	New York	Geo. W. Mason.
	National Line.	
Br.	s. s. Canada	J. Robinson.
	Egypt	J. Sumner.
	England	A. F. Heeley.
	Erin	Thos. Foot.
	France	A. D. Hadley.
	Greece	A. J. Joffrey.
	Helvetia	G. Cochrane.
	Holland	Wm. Tyson.
	Italy	Wm. Pearce.
	Spain	W. A. Griffiths.
	The Queen	T. P. Heely.
	New York and Cuba Mail S. S. Co.	
Am.	s. s. Cienfuegos	F. M. Faircloth.
	N. Y., Havana & Mexican Mail S. S. Co.	
Am.	s. s. City of Alexandria	J. W. Reynolds.
	City of Washington	W. M. Rittig.
	North German Lloyd Steamship Co.	
Ger.	s. s. Aller	H. Christoffers.
	Donau	M. Moller.
	Eider	P. H. Berdrow.
	Elbe	G. Meyer.
	Ems	Th. Jungst.
	Fulda	R. Ringk.
	Hermann	
	Main	H. Boedeker.
	Rhein	W. Topser
	Saale	H. Richter.
	Trave	W. Willigerod.
	Werra	E. Bussius.
	Weser	H. Bruns.
	Ocean Steamship Company.	
Am.	s. s. City of Augusta	J. W. Catherine.
	Old Dominion Steamship Company.	
Am.	s. s. Breakwater	J. E. Dole.
	Manhattan	Frank Stevens.
	Pacific Mail Steamship Company.	
Am.	s. s. City of New York	R. R. Searle.
	City of Para	L. Dexter
	Colon	F. Henderson.
	Newport	W. G. Shackford.
	Quebec Steamship Company.	
Br.	s. s. Muriel	G. S. Locke.
	Orinoco	James S. Garvin.
	Red "D" Line.	
Am.	s. s. Philadelphia	Sam. Hess.
	Valencia	Wm. Woodrick.
	Red Star Line.	
Belg.	s. s. Belgenland	W. A. Boynon.
	Nederland	A. J. Griffin.
	Noordland	H. E. Nickels.
	Pennland	Rud Weyer.
	Rhyniand	J. C. Jamison.
	Switzerland	J. Ueberweg.
	Vaderland	C. H. Grant.
	Waesland	H. Buschmann.
	Westernland	Com. W. G. Randle.
	Rotterdam Line.	
Dtch.	s. s. Edam	Capt. J. H. Taat.
	P. Caland	F. H. Bonjer.
	Leerdam	G. Stenger.
	Schiedam	A. Potjer.
	Rotterdam	G. J. Vis.
	Royal Mail Steamship Co.	
Am.	s. s. City of Dallas	C. W. Read.
	State Line.	
Br.	s. s. State of Georgia	G. Moodie.
	State of Indiana	A. Ritchie.
	State of Nebraska	A. G. Brass.
	State of Nevada	J. A. Stewart.
	State of Pennsylvania	A. J. A. Mann.
	Thingvalla Line.	
Dan.	s. s. Geiser	C. W. Möller.
	Hekla	A. G. Thomsen.
	Island	W. Skjodt.
	Thingvalla	S. T. H. Laub.
	Twin Screw Line.	
Br.	s. s. Richmond Hill	A. Hyde.

	Name of vessel.	Captain.
	Union Line.	
Ger.	s. s. Amalfi	Capt. Julius Bahr.
	Australia	G. Franck.
	California	O. Winkler.
	Marsala	N. Masse.
	Polaria	Johannes Schade.
	Polynesia	A. Kuhn.
	Warren Line.	
	Iowa	E. W. Owens.
	Kansas	W. Gleig.
	Norseman	D. Morris.
	White Cross Line.	
Belg.	s. s. DeRuyter	J. J. Brarens.
	White Star Line.	
Br.	s. s. Adriatic	I. G. Cameron.
	Arabic	Geo. Burton
	Britannic	H. Parsell.
	Celtic	P. J. Irving.
	Germanic	Benj. Glendell.
	Wilson Line.	
Br.	s. s. Buffalo	J. H. Malet.
	Chicago	J. W. Jones
	Egyptain Monarch	John Harrison
	Galileo	R. T. Jones.
	Marengo	T. M. Irwin.
	Martello	Wm. Abbott.
	Otranto	W. Eippeth.
	Persian Monarch	Bristow.
	Salerno	B. H. Rogers.
	Santiago	R. Potter.
	Sorrento	F. W. Ouston.
	Miscellaneous.	
Br.	s. s. Beechville	T. W. Watson.
	Ben Ledi	S. Adamson.
Span.	Carolina	Alex. Ugalde.
Br.	Cyprus	E. Gallo.
	Duke of Buckingham	T. C. Burnside.
	Earnmoor	R. J. Grey.
	Gwendoline	Robert Milburn.
Span.	Hugo	A. de Mugica.
Br.	Kings Cross	G. J. Mills.
Am.	Light-ship No. 37	Andrew Jackson.
	Lorenzo D. Baker	W. F. Wiley.
Span.	Manuel L. Villaverde	A. Gardon.
Br.	Merchant Prince	Chas. Taylor.
	Napier	J. W. W. Hender-
	Pawnee	John James. [son.
	Pomona	J. Legoe.
	Saint Ronans	Henry Campbell.
Span.	Serra	F. de Lusarago.
Belg.	Strabo	A. Matheson.
Br.	Straits of Gibraltar	G. Griggs.
	Strathleven	C. W. Pearse
	Surrey	R. Griffiths.
	Thornhill	James Wethers
	Viola	L. Murray.
	Wylo	T. L. Rogers.
	New York Herald Weather Service.	
Br.	s. s. Advance	J. Lord.
	Alaska	Geo. S. Murray.
Am.	Algiers	J. B. Percy.
Br.	Barracouta	Robert Hubbard.
	Caracas	N. M. Hopkins.
	Denmark	H. S. Rigby.
Am.	El Monte	J. W. Hawthorn.
	El Paso	H. S. Quick.
	Knickerbocker	F. Kemble.
Br.	Landaff City	T. H. Gore.
	Nova Scotian	R. H. Hughes.
Am.	Portia	Henry Dawson.
Br.	Samana	W. Taylor.
	Sailing vessels.	
Br.	bk. Achnah	Alfred M. Shaw.
Am.	bk. Alice	W. G. Kair.
Ger.	bk. Atlantic	A. Witte.
Am.	bgt. Bonny Doon	Chas. Burgess.
	schr. C. B. Church	N. A. Anderson.
Br.	sp. Chas. S. Whitney	Geo. D. Spicer.
Ger.	bk. Cornelius	H. Windhorst.
	sp. Dakota	N. K. Schaller.
Am.	bk. Evanell	Mate A. P. Goodman.
Ger.	sp. Fidelio	Capt. T. H. Schutte.
Am.	schr. Florence Rogers	J. S. F. McLeod.
Ger.	sp. Georg	G. Schiotz.
Nor.	bk. Grundloven	O. G. Ellingsen.
	Hermon	O. Olsen.
Br.	bk. Jose E. More	A. Lenhard.
Port.	bk. Julius	F. D. Vieira.
Ger.	Kepler	G. Atken.
It.	bk. Lazzaro Bianchia	Dallorso Nicola.
Am.	bg. L. F. Munson	J. V. McKowen.
	Lilian	H. T. Schive.
Nor.	bk. Martin Luther	A. O. Arneson.
	Qvos	G. Olsen.
Ger.	bk. Richard	A. von Seggern.
Br.	sp. Sapphire	G. W. Murray.
Am.	bk. Sarah	L. B. Hale.
	bk. Sarah Doe	B. S. Merryman.
Ger.	bk. Western Chief	Fr. Sander.
Br.	sp. Winnifred	M. MacDonald.

UNITED STATES SIGNAL SERVICE

MONTHLY WEATHER REVIEW.

VOL. XV. WASHINGTON CITY, NOVEMBER, 1887. No. 11.

INTRODUCTION.

This REVIEW treats generally the meteorological conditions of the United States and Canada for November, 1887, and is based upon the reports of regular and voluntary observers of both countries. Descriptions of the storms that occurred over the north Atlantic Ocean are also given, and their paths shown on chart i, on which also appear the limits of fog-belts west of the fortieth meridian. No ocean ice has been reported.

East of the Mississippi River and on the north Pacific coast the temperature was about normal, but in all districts west of the ninety-fifth meridian, except the north Pacific coast, the month was decidedly warmer than the average, the departures from the normal temperatures amounting to from 4° to 6° in the central and southern Rocky Mountain districts.

The rainfall in general was below the average in all parts of the country, the deficiency being greatest in the east Gulf states, where the rainfall was only about 15 per cent. of the normal.

Some special data in connection with the deficiency of rainfall during the period from March to November, 1887, is given under the heading "Drought," from which it is shown that over an extensive area the rainfall of the period mentioned is less than 60 per cent. of the normal.

Chart iii formerly issued with the REVIEW has been discontinued, and will not therefore appear in future REVIEWS.

A new chart (similar to number v of the REVIEW for July, 1887), numbered iii, accompanies this issue.

In the preparation of this REVIEW the following data, received up to December 20, 1887, have been used, viz., the regular tri-daily weather-charts, containing data of simultaneous observations taken at 133 Signal Service stations and 2[illegible] Canadian stations, as telegraphed to this office; 170 monthly journals and 168 monthly means from the former and 23 monthly means from the latter; 268 monthly registers from voluntary observers; 60 monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports through the co-operation of the "New York Herald Weather Service;" monthly weather reports from the local weather services of Alabama, Illinois, Indiana, Kansas, Louisiana, Michigan, Missouri, Nebraska, New England, New Jersey, North Carolina, Ohio, Oregon, Pennsylvania, and Tennessee, and the Central Pacific Railway Company; trustworthy newspaper extracts, and special reports.

ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean pressure for November, 1887, determined from the tri-daily telegraphic observations of the Signal Service, is shown by isobarometric lines on chart ii.

As to the region covered by the area of greatest mean pressure, the November chart is similar to that for the preceding month, and it may be said that the general distribution of pressure for November does not materially differ from that for October, the range (.27) in the monthly means being considerably less than during the two preceding months. From the area of barometric maxima, which covers portions of the middle and southern plateau regions, the gradient is steepest to the northward and northwestward, the mean pressure at Olympia, Wash., being 30.01, and at Calgarry, British Northwest Territory, 29.98; the decline of pressure is least to the southeastward, the barometric means falling to slightly below 30.1 over the eastern Rocky Mountain slope, and thence increasing to 30.16 at Knoxville, Tenn. While the region of least mean pressure for October was a part of the southern plateau, that for the current month is the Gulf of Saint Lawrence and the Canadian provinces to the westward. The barometric means of November, compared with those of the preceding month, show an increase over nearly the whole country, the exception being the region extending from Dakota westward to the Pacific coast (where deficiencies occur) and the central Mississippi and lower Ohio valleys (where no change is shown). The deficiency is greatest on the north Pacific coast, and the greatest excesses are in the southern plateau and portions of the south Atlantic and east Gulf states, the extreme departures being: Olympia, Wash., .17 deficiency; and Cedar Keys, Fla., and Yuma, Ariz., excess .11 and .12, respectively.

The departures from the normal pressure for the various stations are given in the table of miscellaneous meteorological data. The mean pressure of the current month so nearly corresponds with the normal that there is but one comparatively small area, embracing portions of the lower lake region, New England, and the middle Atlantic states, over which the departures (deficiencies) amount to or exceed .05. The extreme departures are: deficiency, New London, Conn., .08; excess, La Crosse, Wis., .04.

BAROMETRIC RANGES.

The monthly barometric ranges at the various Signal Service stations are also given in the table of miscellaneous meteorological data. The ranges, as usual, conform to the general rule, that is, they increase with the latitude and decrease slightly, though somewhat irregularly, with increasing longitude. A comparison of the barometric ranges of the current month with the November normal ranges shows no marked contrast, except over the region extending from Minnesota eastward to the New England coast where they are much greater than usual, the departure in the upper lake region amounting to about .50. In the states bordering on the Atlantic the extreme ranges are, .32 at Key West, Fla., and 1.76 at Portland, Me.; over the interior of the country, .48 at Galveston, Tex., and 1.77 at Escanaba, Mich.; on the Pacific coast, .45 at San Diego, Cal., and 1.09 at Port Angeles and Tatoosh Island, Wash.

AREAS OF HIGH PRESSURE.

Six areas of high pressure were observed within the limits of territory covered by the daily weather charts during the month of November. Two of these areas apparently ap-

proached the north Pacific coast from the west and crossed the continent, moving in a southeasterly direction. Three were first observed at the northern Rocky Mountain stations, two of which passed directly east, the centre of greatest pressure remaining near the fiftieth parallel, and the third passed first over the eastern Rocky Mountain slope and thence eastward from Kansas to the Saint Lawrence Valley. The sixth area of high pressure observed apparently developed near Lake Superior and descended southward over the eastern portion of the United States, the greatest direction of movement being to the southeast.

The following is a description of the areas of high pressure observed, and the general weather conditions attending each:

The month opened with northeasterly gales along the middle Atlantic and New England coasts. These gales resulted from a disturbance traced as an ocean storm and partially described in the October REVIEW, and the advance of the accompanying area of high pressure which covered the Saint Lawrence Valley and the lower lake region on the 1st. This area of high pressure extended southward to the Gulf and south Atlantic states, attended by generally fair weather during the first week of the month over the greater portion of the United States.

I.—This high area appeared on the north Pacific coast on the 2d, but it had been preceded by high barometric readings in the Rocky Mountain and plateau regions. It was well defined on the morning of the 4th, central in western Nebraska, moving slowly to the southeast in the rear of a cyclonic disturbance then covering the upper Saint Lawrence valley. By the morning of the 5th this area of high pressure extended over the central valleys, the pressure having decreased slightly within both the high and low areas referred to above, while the easterly movement of each had been approximately nine hundred miles during the preceding twenty-four hours. This area extended over the eastern portion of the country on the 5th, the line of greatest pressure coinciding nearly with the twenty-fifth parallel, and it was last observed off the North Carolina coast on the 7th.

II.—On the morning of the 7th this area of high pressure was apparently forming in the upper Missouri valley, and the weather chart of that date showed that a disturbance had formed rapidly over the western portion of Lake Superior. This high area moved directly east, attended by increasing pressure at the centre, and the depression above referred to showed a corresponding increase of pressure until its centre had passed to the northeast of the Maritime Provinces. The barometer rose over New England and the middle Atlantic states during the 9th, after which this area disappeared, owing to the advance of a storm then moving northeast over the Lake region.

III.—The a. m. tri-daily weather chart of the 11th shows a cyclonic disturbance of great energy central on the coast of Maine, the barometer at Eastport being 29.14, while the pressure ranged from 30.20 to 30.24 in the vicinity of Lake Superior. Reports on this and the preceding charts indicate that this area formed over the upper lake region. The pressure increased over the eastern half of the United States during the 12th, the line of greatest pressure extending from Lake Superior to Virginia, thus making an angle of about 90° with the track of the centre of the preceding low area. It became more extended as it approached the coast, and the pressure diminished about .2 during its southeasterly movement.

IV.—The barometer remained generally above the normal on the north Pacific coast from the 15th to the 20th, during which time this area was gradually extending eastward over the Rocky Mountains and central valleys. On the morning of the 20th the barometer was highest over the central plateau regions, but this area was clearly defined over northern Texas. After the 20th the pressure diminished west of the Rocky Mountains, and that portion over Texas moved first southward and then eastward along the Gulf coast, attended by the lowest observed temperature of the month on the east Gulf coast and in northern Florida. Killing frosts occurred at Pensacola and Jacksonville on the morning of the 21st, while this area was central over Alabama. The pressure increased as it approached the coast, the barometer reading 30.20 while it was central over Texas, and 30.40 when it was last observed east of Hatteras.

V.—This high area appeared north of Montana on the 21st and extended eastward over the northern portion of the United States, the centre remaining to the north of the Lakes and the Saint Lawrence Valley, and the pressure increasing during the easterly movement, the barometer having risen to 30.60 and above at the extreme northeast stations. The most marked changes in temperature during the passage of this high area occurred in the lower Missouri and central Mississippi valleys, but these changes were not sufficient to justify a portion of the cold-wave signals displayed in advance of it.

VI.—This area appeared in the northern Rocky Mountain region on the 24th, and after remaining almost stationary for twenty-four hours it passed southward over the Missouri Valley, attended by the most severe cold wave of the month. The temperature fell below —30° in Manitoba, and to —24° at North Platte, Nebr., on the 27th, when the barometer was highest in Kansas. At many stations in the central valleys the temperature fell from 30° to 50° in twenty-four hours. A severe "norther" occurred in Texas and Indian Territory, for which the railroads in the Southwest generally received timely warning. The track of the centre of this area of high pressure extended from north of northern Montana to western Kansas and thence eastward to Lake Erie, after which it passed northward of the Lake region, where this area was re-enforced, thus forming the most extended area of high pressure observed during the month, and within which were observed the maximum barometric readings at stations in the Saint Lawrence Valley recorded during the past fifteen years.

The a. m. chart of December 1st shows a well-marked high area, bounded by an isobar of 31.10, over the region named above, and all stations east of the Rocky Mountains were included within the limits of this barometric condition.

AREAS OF LOW PRESSURE.

Ten areas of low pressure were observed within the limits of the United States or adjoining territories during the month of November. The mean latitude of the tracks of the centres of these areas of low pressure was slightly to the north of the mean storm tracks for November. Of the ten disturbances traced on chart number i six probably developed to the east of the Rocky Mountains, and five were attended by secondary depressions which developed in the southern quadrants of the principal depressions. The most severe storms of the month resulted from secondary disturbances which developed south of New England while the principal disturbance was central in the Saint Lawrence Valley. During the month no barometric depression passed over the south Atlantic states, Ohio Valley, or the middle Atlantic states south of New York.

The following table shows the latitude and longitude in which each area was first and last observed, and the average hourly velocity in miles per hour:

Number of area.	First observed.		Last observed.		Average hourly velocity.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
	° ′	° ′	° ′	° ′	*Miles.*
I	52 00	98 00	52 00	69 00	43.0
II	47 00	99 00	50 00	65 00	36.0
III	52 00	99 00	51 00	83 00	43.0
III*a*	47 00	90 00	50 00	70 00	50.0
IV	39 00	92 00	47 30	72 00	32.0
IV*a*	41 30	71 00	45 00	66 00	17.0
V	50 00	109 00	44 00	77 00	27.0
V*a*	40 00	72 00	47 00	65 00	27.0
VI	44 00	103 00	47 00	79 00	32.0
VII	50 00	102 00	47 00	70 00	38.0
VIII	53 00	110 00	52 00	90 00	28.0
VIII*a*	45 00	107 00	37 00	95 00	28.0
IX	36 00	91 00	43 00	84 00	30.0
X	39 00	91 00	49 00	67 00	33.0

Average rate of progress, 33.0 miles per hour.

I.—This area of low pressure was central north of Manitoba on the morning of the 1st, the barometer near the centre being 29.74, and at the same report the depression previously described as an ocean storm was central off the middle Atlantic coast, attended by severe northerly gales at coast stations between Hatteras, N. C., and Boston, Mass. The depression traced as number i for the current month passed rapidly eastward, the centre remaining north of the stations of observation, without causing any marked change in the weather conditions within the limits of the United States. It was last observed in the Saint Lawrence Valley on the 2d, when the central area became much extended and the disturbance apparently decreased in energy.

II.—This low area apparently formed in the upper Missouri valley, where it was central at the 10 p. m. report of the 2d; it moved slowly eastward, inclining slightly southward during the 3d, and passed over the Lake region with increasing energy; the barometric pressure at the centre diminished from 29.9 to 29.28 during the passage of this area from Dakota to the lower Saint Lawrence valley, where the principal disturbance attending this condition was central on the afternoon of the 4th, attended by westerly gales in the Lake region and on the New England coast. The maximum force of the wind attending this storm probably occurred during the 4th, as the pressure was rising near the centre of disturbance when last observed passing to the east of the Maritime Provinces. The central area was almost circular in form until it reached the lower Saint Lawrence valley, after which the isobars for southern quadrants extended southward along the Atlantic coast, forming an elongated depression within which the winds attained dangerous velocities from the south, quickly shifting to westward as the storm-centre advanced.

III.—This disturbance probably developed in the northern Rocky Mountain region or on the north Pacific coast, but its centre was first located on the tri-daily weather chart to the north of Manitoba on the morning of the 6th, the reports for the preceding day indicating unusually low barometric pressures to the north of Dakota and Montana. It passed eastward during the succeeding twenty-four hours as an extended depression whose centre was far to the north of the stations of observation, but the area of high pressure then covering the Atlantic coast districts caused an increasing barometric gradient in the Lake region, attended by brisk and high southwesterly winds. The principal disturbance could not be traced farther to the eastward than the eighty-second meridian, but a secondary disturbance developed over the west portion of Lake Superior during the night of the 6th and moved directly eastward, following the general course of the Saint Lawrence Valley, causing the westerly gales to continue during the 7th in the upper lake region, and during the 8th in the lower lake region and Saint Lawrence Valley.

IV.—This storm partially developed in the southwest during the 8th, but it became defined as a cyclonic disturbance in the central valleys on the morning of the 9th, when the tri-daily weather chart exhibited areas of high pressure central over the Saint Lawrence Valley and the Rocky Mountain region, and as the disturbance passed eastward during the 9th general rains occurred over the drought region and the area of precipitation extended eastward, including all states east of the Mississippi. The winds increased in force as the storm passed over the Lake region, the depression being circular in type while passing over the lower lake region, with an apparent tendency to pass into an elongated or loop-shaped type in the southern quadrants. The primary disturbance was distinctly traced to the lower Saint Lawrence valley, while a secondary depression formed suddenly on the southern New England coast during the night of the 10th, developing great energy along the New England coast, where the pressure diminished from 30.1 to 29.1 at Eastport, Me., during the twenty-four hours ending at 7 a. m. of the 11th. The gales attending this secondary depression were of unusual severity, the wind reaching a maximum velocity of fifty miles per hour at Eastport on the 11th; the gradient and winds also increased to the westward over the lower lake region during the same day. The storm was central near Eastport on the afternoon of the 11th, when the pressure was increasing at the centre. It passed to the eastward of the coast stations and continued its easterly course as an ocean storm, the centre of which is traced as number 8 on chart i.

V.—The tri-daily weather charts of the 10th and 11th show that a barometric depression passed over the north Pacific coast, but is was not possible to definitely trace this disturbance to the west of the one hundred and tenth meridian. It was observed north of Montana on the 12th, the isobars bounding the centre trending to the southeastward, covering the greater portions of the Missouri Valley. It passed eastward, attended by light rains, during the 13th, and after reaching the longitude of Lake Superior it was apparently drawn southeastward over the Lake region. The pressure remained about stationary at the centre of this disturbance during its transit from north of Montana to near Lake Erie, where it disappeared, a secondary disturbance forming during the night of the 14th on the southern New England coast. As in the preceding storm on this coast, this disturbance moved northward, following the general direction of the coast line, causing severe gales and heavy rains, with snow in the interior. It continued its course to the northeast over the Maritime Provinces, but after passing over New England the barometric gradient diminished, and although gales were reported the storm lost force and the central area became greatly extended.

VI.—The afternoon report of the 15th exhibited a trough-shaped depression covering the eastern slope of the Rocky Mountains, within which the centre of lowest pressure was located in southeast Dakota. This condition moved slowly eastward, covering the Missouri and Mississippi valleys, without causing any marked change in the weather conditions, the centre of disturbance passing over Nebraska, Iowa, Illinois, and to southern Michigan, where it was located on the afternoon of the 16th. Fair weather continued generally throughout the United States during the passage of this depression, which disappeared to the northeast of Lake Huron, after which it apparently formed a part of the area of low pressure then covering the Gulf of Saint Lawrence.

VII.—This area of low pressure was first observed north of Dakota on the 18th when an area of high barometer extended from the north Pacific coast southeastward to the Ohio Valley, and the barometer was unusually low from the northern Rocky Mountains eastward to the Saint Lawrence Valley. The pressure at the centre of this depression diminished as it moved southeastward to the Lake region, where it was central near Duluth, Minn., the barometer reading 29.26. It continued its southeasterly course during the 19th, passing over lower Michigan, where the minimum pressure, 29.14, was observed at Grand Haven, and the centre was near that station on the afternoon of the 19th. This disturbance extended to the eastward over New England, becoming greatly elongated, but the strongest winds occurred in the west quadrants, attended by a cold wave which extended over the central valleys. The direction of movement of this disturbance changed from southeast to northeast when the centre was near Lake Huron, and it disappeared, following the general course of the Saint Lawrence Valley, during the 20th.

VIII and IX.—When the preceding disturbance extended over the lower Saint Lawrence valley number viii was observed moving eastward from the region north of Montana. At the same time slight areas of high pressure extended over the lower Mississippi valley and central Rocky Mountain stations. This area moved eastward, inclining towards the upper lake region, attended by light snows at northern stations, and after reaching the ninetieth meridian a secondary depression developed in the upper Missouri valley, which was apparently forced to the southward by the advance of an area of high pressure and a cold wave from the north. The primary disturbance disappeared to the northeast of Lake Superior on the 21st, and the secondary depression disappeared by a gradual

increase of pressure, after being forced southward to Kansas and northern Texas.

Although the disturbance traced as number ix formed in the central Mississippi valley, within the barometric trough which separated the area of high pressure to the north and that which extended over the south Atlantic coast, heavy rains occurred over the states in the Ohio, Mississippi, and lower Missouri valleys during the 23d and 24th. This area of low pressure moved northward to southern Michigan, where it disappeared, by an increase of pressure, on the 25th.

X.—The tri-daily weather charts of the 25th exhibited an extensive area of low pressure covering the central and southern plateau regions and extending southeastward to Texas, and from this region a barometric trough extended northeastward to the Lake region. The most decided cold wave of the month was moving rapidly southward over the Rocky Mountain stations and the Missouri Valley, and the cold air from this area of high pressure apparently replaced the area of low pressure to the westward, and the barometric trough to the eastward was followed by an elliptical area of low pressure extending from Arkansas to northern Michigan, and this was followed by a normal area of low pressure over the Saint Lawrence Valley, which disappeared on the 28th to the east of the stations of observation.

The snow and rain attending this disturbance was apparently caused by sudden changes of temperature due to the advance of a cold wave, the range of temperature amounting to from 40° to 50°.

NORTH ATLANTIC STORMS FOR NOVEMBER, 1887.

[Pressure in inches and millimetres; wind-force by Beaufort scale.]

The paths of the depressions that have appeared over the north Atlantic Ocean during the month are determined from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; reports received through the co-operation of the "New York Herald Weather Service," and the Hydrographic Office, U. S. Navy; and from other miscellaneous data received to December 21, 1887.

Fourteen depressions are traced, of which two are continuations of storms charted for October, 1887; three traversed the ocean from coast to coast; one first appeared east of the fifteenth meridian; five passed eastward over, or to the northward of, Newfoundland; one apparently originated south of Nova Scotia, and three are given probable paths northward from the sub-tropical region. The general direction of movement of the depressions was east-northeast, and their tracks were rather evenly distributed along, and north of, the trans-Atlantic routes. The first decade of the month was chacterized by severe weather over the entire ocean north of the fortieth parallel. During the second decade stormy weather continued to the westward of the thirtieth meridian until the 16th; after which the passage of two areas of low pressure southeastward over the British Isles was accompanied by unsettled meteorological conditions until the 22d. From the 10th to the 12th, inclusive, a depression advanced northeastward in the vicinity of the Azores. During the third decade of the month the barometer rose slowly over the British Isles from the 22d to the 24th, after which storms of moderate force prevailed until the 30th, when the barometer rose rapidly, with light to fresh westerly winds and fair weather; over the ocean west of the thirtieth meridian settled weather and high pressure prevailed in the trans-Atlantic routes, except from the 23d to the 25th, inclusive, while to the southward of the thirtieth parallel two depressions appeared on the 29th and 30th.

In November, 1886, twelve depressions were traced, the tracks predominating east of the forty-fifth meridian, with a general north of east direction of movement. The general character of the weather over the north Atlantic was exceedingly severe, and terrific westerly gales, with tremendous seas, were reported during the first half of the month. Violent storms, occasioned by barometric depressions which passed over the eastern portion of the United States without advancing beyond the coast line, were experienced in the Maritime Provinces and over the ocean west of the sixtieth meridian. The first, and a portion of the second, decades of the month were marked by storms of great violence over the British Isles and adjacent waters. For the first decade five depressions were traced; for the second, three, and for the third, four.

In November, 1887, the month opened with low barometric pressure and gales over the entire ocean, except in the vicinity of the Azores, where the barometer ranged high. Over the eastern portion of the ocean the weather was particularly severe, the British Isles and the west-central European coast being swept by hurricanes, causing great loss of life and destruction of property. Along the middle Atlantic and New England coasts, and over the Canadian Maritime Provinces, heavy northerly gales prevailed on the 1st, during which many sailing vessels were damaged or driven ashore. From the 1st to the 5th, inclusive, heavy gales continued east of the fortieth meridian, with barometric minima ranging below 29.00 (736.6). From the 6th to the 14th the weather was comparatively settled over the British Isles, while in the vicinity of Newfoundland there was a succession of gales of moderate strength. During this period the barometric pressure in the vicinity of the Azores was generally low and fluctuating. From the 15th to the 21st the passage of depressions northeastward along the middle Atlantic and New England coasts caused unsettled weather south of Nova Scotia and Newfoundland; over mid-ocean the pressure continued high; over the British Isles the barometer fell rapidly during the 17th, and continued low until the 22d, attending the passage of two areas of low pressure. During the last ten days of the month high barometer and fair weather prevailed along the American coast south of the fiftieth parallel; over the ocean east of Newfoundland fair weather and rising barometer followed the passage of a depression which advanced to the northward of the British Isles during the 27th. No storms appeared in the tropical or sub-tropical regions until the last two days of the month, when the presence of depressions, one to the northward of the West Indies and the other to the southwestward of the Azores, was indicated.

The following are descriptions of the depressions traced:

1.—This depression was a continuation of ocean storm number 16 traced for October, 1887, and, as an apparent subsidiary development to depression number 14 charted for that month, closely followed the latter in its passage over the British Isles. At 12 noon on the 1st this storm was central west of Ireland, with barometric pressure below 28.40 (721.3). By the 2d it had apparently moved eastward over the North Sea beyond the region of observation. The disturbances attending this depression caused an immense amount of damage to property, and many lives were lost by the foundering or going ashore of vessels. The following reports indicate the character of weather encountered off the coasts of the British Isles: Capt. G. Franck, of the s. s. "Australia," reports a hurricane on the 1st; wind veered from se. on October 31st to nw. during November 1st; lowest barometer, 28.38 (720.8), at 2 a. m. of the 1st, in N. 49° 47′, W. 8° 45′. Capt. W. A. Beynon, of the s. s. "Belgenland," reports a westerly storm on October 31st and November 1st; lowest barometer, 28.32 (719.3), at 1.30 a. m. of the 1st, in N. 50° 15′, W. 10° 12′. The storm was marked by squalls of hurricane force.

2.—This depression was a continuation of ocean storm number 15 charted for October, 1887, and is traced from off the American coast, in N. 37°, on the 1st, to the French coast by the 6th. The depression increased in energy until the 5th, when central west of Ireland, after which it moved east-south-

east into France, with a slight increase in barometric pressure. The following reports show the character of the disturbances which attended its passage: "Provincetown, Mass., Nov. 1.—The heaviest 'norther' of the season has been blowing along Cape Cod to-day, the wind reaching a velocity of sixty miles per hour." Capt. Vogelgesang, of the s. s. "Rhaetia," reports a storm from the 2d to the 5th; wind veered from ssw. to ne.; lowest barometer, 28.64 (727.4), at 4 p. m. of the 3d, in N. 49° 43′, W. 50° 56′. The s. s. "Egypt" encountered a ssw. to nw. storm during the 4th and 5th; lowest barometer, 29.19 (741.4), at 4 p. m. of the 4th, in N. 50° 36′, W. 27° 10′. Capt. G. Franck, of the s. s. "Australia," reports a storm on the 5th and 6th; wind veered from s. to n.; lowest barometer, 29.23 (742.4), at 3 a. m. of the 5th, in N. 49° 30′, W. 17° 20′.

3.—This depression appeared northeast of Newfoundland on the 1st, and moved rapidly east-northeast to the vicinity of the Hebrides Islands by the 3d; remaining nearly stationary over the northern portion of the British Isles during the following two dates, the storm-centre apparently passed southward after the 5th and united with depression number 2. This storm possessed great energy throughout, and barometric pressure below 29.00 (736.6) was shown from the 2d to the 4th, inclusive. The following reports have been made relative to disturbances encountered during its passage:

Captain Sargent, of the s. s. "Ohio," reports a westerly storm during October 31st and November 1st; lowest barometer, 29.48 (748.8), at 9.27 a. m. of the 1st, in N. 48° 35′, W. 42° 20′. Captain Boggs, of the s. s. "Indiana," reports a strong sw. to nw. gale from October 31st to November 2d; lowest barometer, 29.42 (747.3), at 4 p. m. of the 1st, in N. 47° 0′, W. 41° 0′. Captain Sumner, of the s. s. "Egypt," reports a hurricane on the 2d and 3d; wind veered from sw. to nw. by w.; lowest barometer, 28.82 (732.0), at 3 a. m. of the 3d, in N. 50° 40′, W. 21° 45′. The s. s. "Australia" experienced a whole w. to nw. gale on the 3d and 4th; lowest barometer, 28.67 (728.2), at noon of the 3d, in N. 49° 42′, W. 12° 30′. Capt. H. Walker, of the s. s. "Cephalonia," reports a whole gale from the 1st to the 3d; wind veered from sw. to nw.; lowest barometer, 29.19 (741.4), at 5.45 a. m., in N. 50° 02′, W. 26° 52′. The s. s. "Vaderland" encountered a northwest storm on the 2d and 3d; lowest barometer, 29.30 (744.2), at 1 p. m. of the 2d, in N. 50° 19′, W. 29° 00′.

4.—This depression apparently originated over the ocean south of Nova Scotia or Newfoundland as a subsidiary development to number 5, with which it had united by the 7th.

5.—This depression was a continuation of an area of low pressure which passed northeast from the Saint Lawrence Valley during the 5th; by the 6th the centre of depression had passed east from the Labrador coast, and by the 7th had moved southeast to the fiftieth parallel; advancing eastward to the thirtieth meridian by the 8th, the depression recurved northward under the influence of an area of high barometric pressure overlying the British Isles and the ocean to the westward; subsequent to the 9th the storm apparently moved westward and united with depression number 6. The following reports refer to this depression: Mr. John Higgins, observer at Saint John's, N. F., reports a southwest gale, with rain, during the night of the 5–6th. During the passage of depression number 4 to the southward of Newfoundland, the s. s. "Sidonian," Captain Jamieson, commanding, encountered a whole sw. to nw. gale, with squalls of hurricane force; lowest barometer, 29.46 (748.3), at noon of the 6th, in N. 42° 12′, W. 59° 20′.

6.—This depression moved eastward over the Gulf of Saint Lawrence and northern Newfoundland during the 8th, and on the morning of the 9th was central northeast of Newfoundland, whence it passed slowly northeast and disappeared beyond observation after the 10th, without evidence of marked energy.

7.—This depression first appeared within the region of observation on the 10th, and is given a probable northeast track over the Azores by the 12th, after which its course cannot be determined, owing to an absence of reports; the presence of an area of low barometric pressure between the Azores and the Portuguese coast was, however, indicated until after the 15th. The storm possessed considerable strength, as is shown by the following reports: Captain James, of the s. s. "Pawnee," reports a strong gale on the 10th and 11th; wind backed from s. to se. and nne.; lowest barometer, 29.37 (746.0), at noon of the 10th, in N. 36° 52′, W. 36° 20′. Captain Brown, of the s. s. "Pontiac," reports a strong gale on the 11th; wind veered from sse. to nnw.; lowest barometer, 29.50 (749.7), at 1 p. m., in N. 35° 30′, W. 29° 00′.

8.—This depression passed southeast from Nova Scotia, and during the 12th and 13th was central off the southern edge of the Banks of Newfoundland; by the 14th the storm-centre had moved northward and united with depression number 9. The following report shows the character of the weather which prevailed during the storm's passage to the southward of the Banks: Capt. A. de Mugica, of the s. s. "Hugo," reports a strong gale on the 11th and 12th; wind veered from sse. to ssw.; lowest barometer, 29.34 (745.2), at 3.30 p. m. of the 12th, in N. 43° 44′, W. 51° 59′.

9.—This depression passed east over northern Newfoundland during the 13th, and, traversing the ocean, advanced southeast over the British Isles during the 18th and 19th and disappeared beyond the region of marine observations. The depression had moderate strength throughout, the disturbances which accompanied it being more severe during the 17th and 18th.

10.—This depression was a continuation of an area of low pressure which moved northeast along the middle Atlantic and New England coasts during the 15th and 16th; during the 17th and 18th the centre of depression passed north of east over Newfoundland from the Gulf of Saint Lawrence, and, subsequent to the 18th, disappeared over the ocean north of the fiftieth parallel. The following reports indicate the character of the weather which attended the passage of this storm: Captain Topser, of the s. s. "Rhein," reports a strong gale on the 15th and 16th; wind veered from se. to w.; lowest barometer, 29.53 (750.0), at noon of the 15th, in N. 39°, W. 69°. Capt. H. Richter, of the s. s. "Saale," reports a strong gale on the 16th and 17th; wind veered from se. to sw.; lowest barometer, 29.25 (742.9), at 8 p. m. of the 16th, in N. 43°, W. 60°. Capt. A. Potjer, of the s. s. "Schiedam," reports a whole gale on the 16th and 17th; wind veered from se. to sw.; lowest barometer, 29.23 (742.4), at 3 a. m. of the 17th, in N. 44°, W. 56°. Capt. E. H. Freeth, of the s. s. "British Princess," reports a whole gale on the 16th and 17th; wind veered from e. to w.; lowest barometer, 29.37 (746.0), at 6.30 a. m. of the 17th, in N. 45° W. 53°.

11.—This depression appeared northwest of Ireland on the 20th, and during that and the succeeding date moved southeast to the French coast, accompanied by fresh to strong gales.

12.—This depression passed eastward from the Labrador coast and was central on the 24th in about N. 54°, W. 41°, whence it advanced to the north of Ireland by the 26th, and subsequently moved northeast beyond the region of observation. The storm exhibited moderate strength and was unattended by noteworthy features.

13.—The path of this depression is approximately located to the northward of the West Indies on the 29th and 30th, a scarcity of reports from that region rendering an accurate location of its centre on those dates impracticable. The following reports show that this depression possessed considerable energy: Captain Evans, of the s. s. "Claribel," reports: "28th, passed Fortune Island, with wind increasing to heavy gale, high sea, and frequent rain squalls. Gale continued from northward and westward, blowing with hurricane force at times until the 29th, in N. 24°, W. 74°, at noon, when wind shifted into ne., with very heavy cross-sea. 30th, in N. 26°, W. 74°, at noon, no abatement in either wind or sea, the latter being more to the northward, with heavy rain and wind squalls; towards midnight encountered three distinct seas, running from n., ne., and nw., those from the n. and ne. being dangerously high." Captain Schütte, of the ship "Fidelio," reports a strong n. by e. gale on the 30th; barometer lowest at 11 p. m., when in N. 35°, W. 68°.

14.—The presence of this depression to the southwest of the Azores during the 29th and 30th was indicated by scattering reports, which, while they allowed of approximately locating its centre and path on those dates and showed that severe weather prevailed, were not sufficiently numerous to admit of determining its probable path previous to the 29th.

OCEAN ICE.

No ice was reported during the month.

In November, 1886, the only ice reported was a berg from fifty to sixty feet high observed on the 2d, in N. 45° 20′, W. 45° 26′, from the s. s. "Elstow."

In November, 1885, the only iceberg reported was observed in N. 48° 00′, W. 51° 10′. In November, 1884, several icebergs were seen in N. 45° 56′, W. 52° 38′. For the corresponding month of 1883 and 1882 no ice was reported.

FOG.

The limits of fog-belts to the westward of the fortieth meridian are shown on chart i by dotted shading.

As compared with the chart for the preceding month, October, 1887, slight changes are shown in the eastern and southern limits of fog in the vicinity of the Newfoundland Banks, while to the westward of the sixtieth meridian there has been an increase in the number of fog-areas reported in the trans-Atlantic tracks and along the coast north of the fortieth parallel.

The meteorological conditions which attended the development of fog on the fourteen dates for which it was reported near Newfoundland were as follows: On the 1st an area of low pressure passing to the northward of the Banks was accompanied during the morning by low barometric readings, southerly winds, and fog. During the 3d dense fog attended the passage of a cyclonic area northeastward over the southern edge of the Banks. On the 6th the conditions were unsettled attending the passage of cyclonic areas, one over, and the other to the northward of, the Banks; no report of fog on that date has, however, been received. From the 8th to the 10th, inclusive, fog prevailed with the passage of a cyclonic area eastward over the Gulf of Saint Lawrence, Newfoundland, and the ocean north of the Banks. During the 12th, 13th, and 14th, the development of fog attended the presence over the Gulf of Saint Lawrence and northern Newfoundland of low barometer areas. On the 17th a cyclonic area moved northeast over northern Newfoundland, and dense fog prevailed over the Banks. From the 20th to the 24th, inclusive, south to east winds and fog prevailed south and southeast of Newfoundland. During this period an area of low pressure moved northeast along the New England coast, over the Gulf of Saint Lawrence, and the ocean north of Newfoundland. Subsequent to the 24th no cyclonic areas appeared near Newfoundland, and no fog was reported.

On the 20th, 27th, and 28th fog was reported off the south coasts of Nova Scotia and Cape Breton Islands. On the first-mentioned date, south to southeast winds prevailed in that region with the presence on the New England coast of an area of low barometer, while during the 27th and 28th the winds were from the southeast quadrant and anti-cyclonic.

During the 25th, 26th, and 27th fog was reported north of the fortieth parallel and west of the sixty-fifth meridian, the winds during that period being generally from south to east and anti-cyclonic.

The following are the limits of fog-areas on the north Atlantic Ocean during November, 1887, as reported by shipmasters:

Date.	Vessel.	Entered.			Cleared.		
		Lat. N.	Lon. W.	Time.	Lat. N.	Lon. W.	Time.
		° ′	° ′		° ′	° ′	
1	S. S. Swansea	.....	.....	.....	45 00	47 30	5.20 p.m.
3	S. s. Caspian	48 35	46 05	7 p. m....	48 18	47 25	Midnight.
8	Fog at Saint John's, N. F.						
9	S. S. Egypt	46 45	47 00	.....	46 15	48 30	
9–10	S. S. City of Richmond	47 49	42 49	.....	48 03	41 51	
12	S. S. Rhein	43 28	51 00	10 a. m....	43 04	52 13	3.30 p. m.
12–13	S. S. Barrowmore	46 00	49 32	11.30 p. m..	45 26	51 08	8 a. m.
13–14	S. S. Marsala	46 22	46 43	11.34 a. m.	45 29	50 59	6.24 a. m.
13–14	S. S. Waesland	46 44	45 48	.....	45 13	50 20	
14	S. S. Rugia	44 40	51 31	1 a. m.....	44 49	50 47	3 a. m.
17	S. S. Hermann	46 43 46 15	46 18 48 43	.....	46 30 46 02	47 40 49 49	
20	S. S. Caspian	44 20	63 40	1 a. m.....	*	*	6 p. m.
20	S. S. Dorian	41 31	47 50	.....	41 33	48 15	
20	S. S. Surrey	48 51	45 01	.....	43 36	47 51	
20	S. S. Scandinavian	44 47	52 57	6 a. m.....	44 32	53 51	9.30 a. m.
20	S. S. Polynesia	46 20	49 00	.....	46 00	50 00	
20	S. S. Noordland	45 05	52 56	.....	44 45	54 03	
20	Fog at Saint John's, N. F.						
21	Fog at Saint John's, N. F.						
21	S. S. Polynesia	45 35	50 50	.....	45 20	51 30	
21	S. S. Noordland	43 00	60 35	.....	42 50	61 15	At inter-
21	S. S. Cephalonia	47 10	43 43	.....	46 22	45 40	[vals.
21–22	S. S. Leerdam	45 58	45 14	8.30 p. m..	45 50	46 32	a. m.
22	Fog at Saint John's, N. F.						
22	S. S. Aurania	44 04	50 06	.....	44 30	48 33	[vals.
22–23	S. S. Cephalonia	45 58	46 45	.....	44 16	52 59	At inter-
22–23	S. S. Strabo	45 00	51 49	.....	47 00	45 00	
23	S. S. Hekla	45 45	50 30	.....	45 00	52 30	
24	.....do	44 30	55 20	.....	43 50	56 45	
25	S. S. Surrey	40 40	66 40	.....	40 15	68 10	
25–26	S. S. Cephalonia	42 24	69 29	.....	42 20	70 53	
25–27	S. S. Yemassee	40 10	74 00	.....	†	†	
26	S. S. Leerdam	40 41	66 20	.....	40 41	66 44	
27–28	S. S. Sarnia	45 42	58 29	.....	44 26	63 22	

*Halifax. †New York City.

TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for November, 1887, is exhibited on chart ii by dotted isothermal lines. In the table of miscellaneous data are given the monthly mean temperatures, with the departures from the normal, for the various stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature, precipitation, and departures from the normal, show respectively the averages for the several districts. The normal for any district may be found by adding the departure to the current mean for the district when the departure is below the normal, and subtracting when above. On chart iii the daily mean temperatures and departures from the normal are graphically shown for selected stations.

The month of November, 1887, was slightly colder than the average in the following-named sections of the country: along the Atlantic coast south of New England, in the Saint Lawrence Valley, lower lake region, lower Ohio valley, and the eastern part of the upper Mississippi valley. In these districts the departures were less than 1° at a majority of stations. There were but two small areas over which the temperature was as much as 2° below the normal, viz., (1) eastern New York (in the vicinity of Albany) and adjacent portions of Massachusetts and Vermont; and (2) the North Carolina coast in the vicinity of Wilmington. In the other districts, embracing much the greater part of the United States, the mean temperatures were above the November normal. The region over which the most marked departures above the normal temperature occurred extends from Idaho southeastward to western Texas, the excess of temperature generally ranging from 4° to 7°.

The following are some of the most marked departures from normal temperatures at Signal Service stations:

Above normal.	°	Below normal.	°
Salt Lake City, Utah	7.7	Wilmington, N. C	3.1
Santa Fé, N. Mex	6.9	Albany, N. Y	2.9
Cheyenne, Wyo	5.0	Portland, Me	2.3
El Paso, Tex	4.2	Key West, Fla	2.0
Red Bluff, Cal	4.2	Norfolk, Va	1.9
Yuma, Aris	4.0	Hatteras, N. C	1.8
Fort Sill, Ind. T	3.9	Grand Haven, Mich	1.8
Fort Grant, Aris	3.6	Savannah, Ga	1.6

RANGES OF TEMPERATURE.

The monthly and the greatest and least daily ranges of temperature at Signal Service stations are given in the table of miscellaneous meteorological data. The region in which the monthly ranges were greatest extends from western Kansas and eastern Colorado northward to British America; they generally

exceeded 90° in this region, and at some stations amounted to 100°, or more; the monthly ranges were least along the central and north Pacific coasts, where they fell to 35°, or below.

The following are some of the extremes:

Greatest.	°	Least.	°
Valentine, Nebr.	106.7	Tatoosh Island, Wash	21.7
North Platte, Nebr.	106.4	Key West, Fla	25.0
Fort Laramie, Wyo	105.7	Fort Canby, Wash	26.1
Huron, Dak	104.0	Astoria, Oregon	29.9
Fort Sully, Dak	103.7	San Francisco, Cal	31.6
Fort Shaw, Mont.	103.5	Port Angeles, Wash	37.2
Fort Assinaboine, Mont	100.4	San Diego, Cal.	37.6
Bismarck, Dak.	99.8	Galveston, Tex	39.2

The greatest daily ranges of temperature exceeded 40° over a large part of the country, including the Rocky Mountain region and Missouri, central Mississippi, and lower Ohio valleys; over the entire country they varied from 11° at Tatoosh Island, Wash., on the 10th, to 55° at Colorado Springs, Colo., on the 27th, and 59° at San Carlos, Ariz., on the 14th.

The least daily ranges varied from 2° at Oswego, N. Y., on the 16th, to 19° at Boisé City, Idaho, on the 27th.

Table of comparative maximum and minimum temperatures for November.

State or Territory.	Stations.	For 1887.		Since establishment of station.				Length of record.
		Max.	Min.	Max.	Year.	Min.	Year.	
		°	°	°		°		Y'rs.
Alabama	Mobile	79.8	25.2	82.0	1879, 1882	27.0	1872, 1881	16
Do	Montgomery	79.0	21.4	83.0	1879, 1882	21.0	1872	16
Arizona	Yuma	90.6	37.8	91.0	1879	31.0	1880	13
Do	Fort Grant	74.7	27.7	79.0	1878, 1879	20.0	1880	9
Arkansas	Fort Smith	79.1	17.0	86.0	1882	22.0	1882	6
Do	Little Rock	77.0	0.4	83.0	1882	10.0	1880	9
California	Los Angeles	86.0	38.8	88.0	1884	34.1	1886	11
Do	San Francisco	73.7	42.1	78.0	1871	41.0	1880	17
Colorado	Denver	73.7	—14.2	76.0	1876, 1879	—18.0	1877	16
Do	Pike's Peak	.....	.....	33.2	1885	—36.0	1880	15
Connecticut	New Haven	62.7	18.0	71.5	1882	2.0	1875	15
Dakota	Bismarck	72.8	—25.0	67.0	1876	—28.0	1875	14
Do	Deadwood	64.3	—10.9	68.0	1878	—16.0	1880	10
Dis. of Columbia	Washington City	70.0	22.7	80.0	1879	12.5	1880	18
Florida	Cedar Keys	77.1	26.8	81.0	1881	33.0	1881	9
Do	Pensacola	76.2	28.3	81.3	1882	28.1	1881	9
Georgia	Augusta	78.4	23.5	84.9	1885	24.0	1873	15
Idaho	Boisé City	71.7	5.6	70.0	1879	7.0	1880	11
Illinois	Cairo	75.1	10.0	80.5	1882	7.0	1872	16
Do	Chicago	67.0	— 1.0	72.0	1874, 1882	— 2.0	1872	16
Indiana	Indianapolis	73.5	3.8	75.0	1879	— 5.0	1880	15
Indian Ter	Fort Sill	76.0	8.1	84.0	1885	— 4.0	1880	11
Iowa	Dubuque	71.5	—12.0	69.5	1880	— 9.0	1875	15
Do	Des Moines	73.4	— 9.1	71.0	1882	0.0	1880	10
Kansas	Dodge City	79.7	—12.9	83.0	1875	— 7.0	1880	14
Do	Leavenworth	80.3	— 4.3	77.0	1874, 1886	0.0	1872	17
Kentucky	Louisville	75.1	8.4	78.0	1879	4.5	1872	16
Louisiana	New Orleans	80.1	34.0	84.7	1885	31.5	1881	17
Do	Shreveport	79.8	26.3	86.0	1882	18.0	1880	15
Maine	Eastport	56.8	4.0	64.0	1882	—13.0	1875	15
Do	Portland	65.7	7.6	66.0	1883	— 6.0	1875	16
Maryland	Baltimore	69.1	25.1	78.0	1879	13.0	1880	16
Massachusetts	Boston	69.4	12.0	75.0	1876	— 2.0	1875	17
Michigan	Marquette	64.5	— 5.3	69.0	1886	— 9.0	1875	14
Do	Grand Haven	58.8	12.7	69.0	1886	0.0	1880	15
Minnesota	Saint Vincent	69.1	—30.2	58.7	1884	—22.0	1883	8
Do	Saint Paul	70.2	—20.5	73.6	1886	—24.5	1875	16
Mississippi	Vicksburg	81.1	27.1	84.8	1885	23.0	1877	16
Missouri	Saint Louis	79.3	10.5	82.0	1879	5.0	1872	17
Montana	Ft. Assinaboine	70.6	—29.8	68.1	1884	—26.8	1886	8
Do	Helena	65.5	—11.1	62.0	1884	—17.0	1880, 1881	8
Nebraska	North Platte	81.2	—25.2	79.0	1876	—10.0	1877	14
Do	Omaha	79.6	—13.6	74.0	1874	— 6.0	1875	15
Nevada	Winnemucca	71.3	— 3.4	70.8	1885	— 9.0	1880	9
New Hampshire	Mt. Washington	.....	.....	51.0	1885	—40.0	1875	17
New Jersey	Atlantic City	63.5	22.8	72.0	1882	10.0	1875	14
New Mexico	Santa Fé	67.0	14.9	77.0	1878	—11.0	1880	15
New York	Buffalo	64.5	14.6	68.3	1881	2.5	1875	15
Do	New York City	67.4	22.7	74.0	1882	7.0	1875	18
North Carolina	Charlotte	73.9	21.5	80.0	1879	18.0	1880	10
Do	Wilmington	73.8	26.0	83.0	1877	20.0	1872	17
Ohio	Cincinnati	74.2	8.2	75.0	1879	5.0	1880	18
Do	Sandusky	68.9	4.2	75.0	1879	0.0	1880	11
Oregon	Portland	68.0	25.2	68.0	1873	23.5	1880	15
Do	Roseburg	69.1	20.0	69.7	1884	17.5	1880	11
Pennsylvania	Pittsburg	74.2	14.2	79.0	1876	4.0	1880	15
Do	Philadelphia	69.6	25.0	77.0	1876	8.0	1875	17
Rhode Island	Block Island	60.0	19.9	70.0	1881	19.0	1880	8
South Carolina	Charleston	77.0	26.4	82.0	1879	26.0	1873	15
Tennessee	Knoxville	73.0	14.7	80.5	1881	11.5	1872	17
Do	Memphis	76.3	17.8	82.0	1879	16.0	1877	15
Texas	Brownsville	80.2	39.7	89.0	1882	30.0	1880	12
Do	Fort Elliott	79.3	— 5.4	83.4	1885	— 5.0	1880	8
Utah	Salt Lake City	67.0	11.3	70.9	1882	3.0	1880	14
Virginia	Lynchburg	75.3	22.4	80.2	1882	13.0	1880	15
Do	Norfolk	73.7	29.7	80.0	1879	20.0	1872	17
Washington	Spokane Falls	58.8	9.8	60.0	1885	3.0	1881	7
Do	Olympia	61.0	19.8	63.0	1884	21.0	1882	11
Wisconsin	La Crosse	67.5	—18.8	70.0	1874	21.0	1875	15
Do	Milwaukee	68.7	— 3.6	70.0	1874, 1882	— 5.0	1880	18
Wyoming	Cheyenne	70.1	—11.5	69.0	1876	—20.0	1875	15

DEVIATIONS FROM NORMAL TEMPERATURES.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperatures for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for November, 1887; (4) the departures of the current month from the normal; (5) and the extreme monthly means for November during the period of observations and the year of occurrence:

State and Station.	County.	(1) Normal for the month of Nov.	(2) Length of record.	(3) Mean for November, 1887.	(4) Departure from normal.	(5) Extreme monthly mean temperature for November.			
						Highest.		Lowest.	
						Am't.	Year.	Am't.	Year.
Arkansas.		°	*Years*	°	°	°		°	
Lead Hill	Boone	47.7	6	46.6	—1.1	50.0	1883	45.2	1886
California.									
Fall Brook	San Diego	54.3	10	56.0	+1.7	57.7	1885	48.6	1879
Sacramento	Sacramento	51.1	22	47.8	—3.3	57.0	1875	44.7	1880
Connecticut.									
Middletown	Middlesex	39.2	29	38.4	—0.8	.....	.....	.....	.....
New Haven	New Haven	40.4	101	40.4	0.0	.....	.....	.....	.....
Waterbury	New Haven	40.5	12	37.4	—3.1	.....	.....	.....	.....
Dakota.									
Webster	Day	31.1	5	30.7	—0.4	.....	.....	.....	.....
Florida.									
Archer	Alachua	61.6	5	61.7	+0.1	.....	.....	.....	.....
Illinois.									
Aurora	Kane	38.2	9	35.4	—2.8	.....	.....	.....	.....
Greenville	Bond	41.7	9	40.8	—0.9	.....	.....	.....	.....
Griggsville	Pike	35.0	7	39.0	+4.0	.....	.....	.....	.....
Mattoon	Coles	40.1	8	39.0	—1.1	.....	.....	.....	.....
Peoria	Peoria	39.6	32	41.1	+1.5	.....	.....	.....	.....
Riley	McHenry	33.0	27	32.6	—0.4	.....	.....	.....	.....
Sandwich	De Kalb	35.9	35	37.2	+1.3	.....	.....	.....	.....
Sycamore	De Kalb	35.4	7	33.3	—2.1	.....	.....	.....	.....
Indiana.									
Connersville	Fayette	40.0	6	39.0	—1.0	.....	.....	.....	.....
Lafayette	Tippecanoe	37.5	8	37.3	—0.2	.....	.....	.....	.....
Logansport	Cass	39.9	33	39.4	—0.5	48.0	1862	30.3	1880
Mauzy	Rush	36.7	7	34.4	—2.3	.....	.....	.....	.....
Spiceland	Henry	38.5	34	38.5	0.0	.....	.....	.....	.....
Sunman	Ripley	40.7	5	40.4	—0.3	.....	.....	.....	.....
Vevay	Switzerland	43.7	21	42.7	—1.0	.....	.....	.....	.....
Worthington	Greene	48.4	6	49.3	+0.9	.....	.....	.....	.....
Iowa.									
Monticello	Jones	33.4	34	32.5	—0.9	41.5	1859	25.0	1868
Kansas.									
Wellington	Sunman	41.4	9	43.8	+2.4	45.5	1879	29.0	1880
Yates Centre	Woodson	39.3	7	39.7	+0.4	48.2	1885	25.7	1880
Maine.									
Belfast	Waldo	36.0	28	36.6	+0.6	.....	.....	.....	.....
Cornish	York	34.9	30	34.2	—0.7	37.7	1860	25.7	1573
Gardiner	Kennebec	35.7	51	35.1	—0.6	.....	.....	.....	.....
Orono	Penobscot	33.5	19	33.9	+0.4	.....	.....	.....	.....
Maryland.									
Cumberland	Alleghany	40.9	16	39.8	—1.1	45.0	1883, '85	35.0	1880
Fallston	Harford	42.3	17	41.6	—0.7	46.7	1870	37.5	1873
Massachusetts.									
Amherst	Hampshire	38.1	50	40.0	+1.9	.....	.....	.....	.....
Cambridge	Middlesex	39.1	65	40.4	+1.3	.....	.....	.....	.....
Fitchburg	Worcester	36.5	31	36.4	—0.1	.....	.....	.....	.....
New Bedford	Bristol	41.8	76	40.7	—1.1	.....	.....	.....	.....
Somerset	Bristol	39.5	17	41.3	+1.8	.....	.....	.....	.....
Springfield	Hampden	41.1	20	38.3	—2.8	.....	.....	.....	.....
Taunton	Bristol	41.3	16	40.2	—1.1	.....	.....	.....	.....
Williamstown	Berkshire	35.7	32	36.4	+0.7	.....	.....	.....	.....
New Brunswick.									
Saint Johns	Saint Johns	35.0	27	35.9	+0.9	.....	.....	.....	.....
New Hampshire.									
Concord	Merrimac	37.5	20	38.0	+0.5	.....	.....	.....	.....
Hanover	Grafton	33.5	27	32.7	—0.8	.....	.....	.....	.....
New Jersey.									
Dover	Morris	39.6	5	38.2	—1.4	.....	.....	.....	.....
New York.									
Factoryville	Tioga	37.0	6	36.3	—0.7	40.0	1883	35.0	1882
Humphrey	Cattaraugus	34.4	4	36.0	+1.6	37.1	1883	30.1	1886
Palermo	Oswego	35.4	34	33.1	—2.3	41.9	1859	26.8	1880
Ohio.									
Wauseon	Fulton	38.7	17	37.1	—1.6	40.3	1883	27.9	1880
Pennsylvania.									
Corry	Erie	36.3	7	36.7	+0.4	39.6	1883	31.6	1880
Dyberry	Wayne	34.6	20	35.0	+0.4	38.2	1878, '81	26.4	1873
Grampian Hills	Clearfield	34.5	17	35.8	+1.3	.....	.....	.....	.....
South Carolina.									
Statesburg	Sumter	53.5	7	52.0	—1.5	55.9	1883	51.2	1882
Rhode Island.									
Providence	Providence	40.2	56	41.1	+0.9	.....	.....	.....	.....
Texas.									
New Ulm	Austin	59.2	16	59.8	+0.6	65.6	1879	49.6	1880
Vermont.									
Lunenburg	Essex	31.5	38	32.5	+1.0	.....	.....	.....	.....
Strafford	Orange	34.0	13	32.8	—1.8	37.9	1886	30.9	1880
Virginia.									
Bird's Nest	Northampt'n	49.4	19	47.8	—1.6	.....	.....	.....	.....
Dale Enterprise	Rockingham	47.5	7	47.4	—0.1	62.3	1883	41.3	1880, '84
Variety Mills	Nelson	44.0	10	42.2	—1.8	47.5	1881	39.5	1880
Wytheville	Wythe	41.9	23	43.7	+1.8	.....	.....	.....	.....
West Virginia.									
Helvetia	Randolph	40.9	11	40.7	—0.2	.....	.....	.....	.....

LOW TEMPERATURE.

Omaha, Nebr.: a minimum temperature of —13°.6 was registered at 8 a. m. on the 27th, this is 7°.6 lower than has previously been recorded in November since the establishment of the Signal Service station in 1871.

MEAN AUTUMNAL TEMPERATURES.

Lead Hill, Boone Co., Ark.: the mean temperature of the autumn of 1887, 59°, is 2° lower than the normal of the past six years; during that period the warmest autumns, 62°, occurred in 1881 and 1884, and the coldest, 59°, in 1885.

Palermo, Oswego Co., N. Y.: the mean temperature of autumn of 1887, 41°, is 5° below the average of the last thirty-four years; the highest autumn mean in that time, 51°, occurred in 1855, and the lowest during the present year.

New Ulm, Austin Co., Tex.: the mean temperature of the autumn of 1887, 68°, is 1° below the average of the last sixteen years.

FROST.

There were no dates during the month on which frost did not occur; they were most extensively reported on the 1st, 2d, 3d, 18th, 21st, 22d, 29th, 30th; they were least frequent on the 7th, 24th, 25th, and 26th.

Freezing temperatures occurred in all parts of the United States during the month, with the following exceptions: extreme southern Florida; along the immediate Gulf coast from the vicinity of Galveston, Tex., to New Orleans, La., and along the immediate coast of the Pacific, with exception of the Oregon coast.

The Signal Service observer at Titusville, Fla., reports: "a minimum temperature of 32°.5 occurred on the 21st; ice formed upon exposed places, slightly damaging tender vegetation. The remarkable escape from frost is doubtless attributed to the smoke and arid condition of the atmosphere and the prevailing fresh breeze, which prevented its formation."

ICE.

Ice formed in the southern parts of the country as follows: Cedar Springs, S. C., 6th, 20th, 21st; Corsicana, Tex., 11th; Oxford, Miss., 20th; Little Rock, Ark., ice of one-half inch in thickness formed on the 20th; ice also formed on the 21st and 27th; Montgomery, Ala., Cedar Keys, Duke, and Pensacola, Fla., Augusta, and Savannah, Ga., 21st; Archer, Fla., 21st, 22d; Willows, Cal., 23d, 24th; Sacramento, Cal., 25th to 27th; Keeler, Cal., 26th; Willcox, Ariz., and Palestine, Tex., 27th; Corpus Christi and San Antonio, Tex., 28th.

TEMPERATURE OF WATER.

The following table shows the maximum, minimum, and mean water temperature, as observed at the harbors of the several stations; the monthly range of water temperature; the average depth at which the observations were made, and the mean temperature of the air:

Temperature of water for November, 1887.

Station.	Temperature at bottom.				Mean temperature of air at the station.	Average depth of water in feet and tenths.
	Max.	Min.	Range.	Monthly mean.		
	°	°	°	°	°	
Canby, Fort, Wash	53.8	45.1	8.7	49.4	46.5	15.6
Cedar Keys, Fla	68.2	54.3	13.9	65.3	62.4	7.3
Charleston, S. C	63.3	54.7	8.6	59.0	56.2	36.6
Eastport, Me	48.3	45.5	2.8	46.5	37.6	16.0
Galveston, Tex	69.8	52.4	17.4	64.4	64.0	14.2
Key West, Fla	79.2	71.7	7.5	75.1	73.0	17.2
New London, Conn	53.8	45.3	8.5	50.0	42.3	11.9
New York City	51.9	43.6	8.3	47.3	43.7	14.8
Pensacola, Fla	71.2	60.4	10.8	67.0	60.2	17.3
Portland, Me	46.6	41.6	5.0	44.2	37.7	16.5

PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for November, 1887, as determined from the reports of about eight hundred stations, is exhibited on chart iv. In the table of miscellaneous meteorological data are given, for each Signal Service station, the total precipitation, with the departures from the normal. The figures opposite the names of the geographical districts in columns for mean temperature, precipitation, and departures from the normal, show respectively the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal, and subtracting when above.

The precipitation for November, 1887, as compared with the normal, is deficient in nearly every part of the United States. The deficiency is most marked in the east Gulf states, where the average rainfall for the month is 0.69, or about fifteen per cent. of the normal. In the south Atlantic states about thirty-five per cent. of the normal amount of rain fell. In other districts east of the Mississippi River the deficiencies have been somewhat less marked, but upon the whole only about sixty per cent. of the normal amount of rain fell at signal stations east of the river named. Between the Mississippi and Rocky Mountains the percentage of deficiency is slightly less than in the districts east of the Mississippi—amounting to about seventy-five per cent—there being a slight excess over the average in the Rio Grande Valley and southern slope. In the middle Pacific coast region the rainfall amounted to about 1.00, which is about one-third the average for that section; in the south Pacific coast region it exceeded the average slightly, and in the north Pacific coast region about 6.00 of rain fell, this amount being slightly below the normal.

DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows for certain stations, as reported by voluntary observers, (1) the average precipitation for a series of years; (2) the length of record during which the observations have been taken, and from which the average has been computed; (3) the total precipitation for November, 1887; (4) the departures of the current month from the average; (5) and the extreme monthly precipitation for November during the period of observations and the year of occurrence:

State and station.	County.	(1) Average for the month of Nov.	(2) Length of record.	(3) Total for November, 1887.	(4) Departure from average.	(5) Extreme monthly precipitation for November.			
						Greatest.		Least.	
						Am't.	Year.	Am't.	Year.
Arkansas.		*Inches*	*Years*	*Inches*	*Inches.*	*Inches*		*Inches.*	
Lead Hill	Boone	4.00	6	3.64	—0.34	5.77	1883	2.50	1885
California.									
Fall Brook	San Diego	1.47	11	2.03	+0.56	5.92	1885	0.00	1883
Sacramento	Sacramento	2.04	22	0.54	—1.50	9.65	1887	trace.	1884
Connecticut.									
Canton	Hartford	4.64	26	2.36	—2.28	.....	.....	.....	.....
Hartford	Hartford	3.46	16	2.21	—1.25	.....	.....	.....	.....
Middletown	Middlesex	3.87	29	2.37	—1.50	.....	.....	.....	.....
Wallingford	New Haven	3.85	29	2.54	—1.31	.....	.....	.....	.....
Dakota.									
Webster	Day	1.86	5	0.29	—1.57	4.33	1886	0.06	1883
Florida.									
Archer	Alachua	1.48	5	0.37	—1.11	.....	.....	.....	.....
Illinois.									
Aledo	Mercer	3.90	10	1.00	—2.90	.....	.....	.....	.....
Mattoon	Coles	3.98	8	6.84	+2.86	.....	.....	.....	.....
Peoria	Peoria	2.31	32	1.62	—0.69	.....	.....	.....	.....
Riley	McHenry	1.98	27	1.87	—0.11	.....	.....	.....	.....
Sandwich	De Kalb	2.76	35	2.35	—0.41	.....	.....	.....	.....
Indiana.									
Logansport	Cass	2.99	33	5.21	+2.22	6.30	1864	0.41	1865
Spiceland	Henry	2.97	27	3.22	+0.25	.....	.....	.....	.....
Vevay	Switzerland	3.08	21	3.05	—0.03	5.73	1883	0.73	1872
Iowa.									
Cresco	Howard	1.37	14	1.03	—0.34	.....	.....	.....	.....
Monticello	Jones	2.32	34	0.77	—1.55	5.29	1879	0.12	1866
Kansas.									
Wellington	Sunman	0.96	9	0.18	—0.78	1.85	1884	0.10	1886
Yates Centre	Woodson	1.71	7	0.39	—1.32	3.18	1881	0.39	1887
Louisiana.									
Grand Coteau	St. Landry	6.42	5	1.86	—4.56	.....	.....	.....	.....

Deviations from average precipitation—Continued.

State and station.	County.	(1) Average for the month of Nov.	(2) Length of record.	(3) Total for November, 1887.	(4) Departure from average.	(5) Extreme monthly precipitation for November.			
						Greatest.		Least.	
						Am't.	Year.	Am't.	Year.
Maine.		*Inches*	*Years*	*Inches*	*Inches.*	*Inches*		*Inches.*	
Cornish	York	3.73	30	4.92	+1.19				
Gardiner	Kennebec	4.30	49	3.64	−0.66				
Lewiston	Androscoggin	4.82	13	5.09	+0.27				
Orono	Penobscot	4.48	19	3.48	−1.00				
Maryland.									
Cumberland	Alleghany	2.08	16	0.82	−1.26	5.10	1877	0.82	1882
Fallston	Harford	3.64	17	2.02	−1.62	10.27	1877	0.45	1887
Massachusetts.									
Amherst	Hampshire	3.80	53	3.54	−0.26				
Cambridge	Middlesex	3.90	47	2.87	−1.03				
Lake Cochituate	Middlesex	4.46	36	2.76	−1.70				
Lynn	Essex	4.09	13	3.09	−1.00				
Mystic Lake	Middlesex	3.88	12	2.94	−0.94				
New Bedford	Bristol	4.27	15	2.60	−1.67				
Somerset	Bristol	4.45	17	2.37	−2.08				
Springfield	Hampden	3.84	40	3.21	−0.63				
Waltham	Middlesex	4.00	63	2.87	−1.13				
Williamstown	Berkshire	2.88	20	3.77	+0.89				
New Brunswick.									
Saint Johns	Saint Johns	5.58	27	3.65	−1.93				
New Hampshire.									
Concord	Merrimac	3.52	32	3.70	+0.18				
Hanover	Grafton	2.53	21	2.98	+0.45				
New Jersey.									
Dover	Morris	3.71	5	1.58	−2.13				
New York.									
Boyd's Corners	Putnam	3.77	21	2.69	−1.08				
Factoryville	Tioga	2.04	6	2.17	+0.13	4.17	1886	0.91	1883
Humphrey	Cattaraugus	3.72	4	2.27	−1.45	6.23	1886	2.71	1885
Palermo	Oswego	3.87	34	3.25	−0.62	8.30	1863	0.30	1882
Ohio.									
Wauseon	Fulton	3.05	15	3.78	+0.73	5.83	1881	1.46	1884
Pennsylvania.									
Grampian Hills	Clearfield	2.85	17	2.28	−0.57				
Dyberry	Wayne	3.09	17	2.60	−0.49	7.10	1886	1.77	1872
Rhode Island.									
Providence	Providence	4.12	56	2.16	−1.96				
South Carolina.									
Stateburg	Sumter	1.89	7	0.93	−0.96	3.90	1882	0.87	1886
Texas.									
Corsicana	Navarro	3.50	3	5.62	+2.12				
New Ulm	Austin	5.10	16	0.48	−4.62	14.93	1873	0.48	1887
Vermont.									
Lunenburg	Essex	3.23	38	2.15	−1.08				
Strafford	Orange	3.60	13	3.70	+0.10			0.90	1882
Virginia.									
Bird's Nest	Northampton	2.22	19	1.80	−0.42				
Dale Enterprise	Rockingham	1.75	7	0.65	−1.10	6.46	1886	0.52	1882
Variety Mills	Nelson	2.18	8	1.02	−1.16	4.63	1880	0.59	1882
Wytheville	Wythe	2.71	23	0.44	−2.27			0.44	1887

The following notes on precipitation are furnished by the voluntary observers:

Lead Hill, Boone Co., Ark.: the precipitation of the autumn of 1887, 9.83, is 1.60 below the autumn average of the last six years; the greatest autumn precipitation, 25.40, occurred in 1883, and the least, 7.36, in 1885.

Logansport, Cass Co., Ind.: the total depth of snowfall for November, 1887, 5, is the same as the average of the past thirty-two years; the highest November snowfall in that period, 18, occurred in 1874, and the least, trace, in 1865. No snow fell during the month in 1860, 1861, and 1883.

Monticello, Jones Co., Iowa: the total depth of snowfall for November, 1887, 4, is 1 above the average of the last thirty-four years; the largest November snowfall in that time, 16, occurred in 1869.

Palermo, Oswego Co., N. Y.: the depth of snowfall for November, 1887, 16, is 9 above the average of the last thirty-four years; the largest November snowfall in that time, 39, occurred in 1880, and the least, 2, in 1877.

New Ulm, Austin Co., Tex.: the total precipitation of the autumn of 1887, 6.44, is 8.32 below the average of the last sixteen years.

Cumberland, Alleghany Co., Md.: the precipitation for the autumn months (September, October, and November) of 1887 is 4.89, or 1.77 below the average of the corresponding period of the past sixteen years.

Jeffersonville, Clark Co., Ind.: the precipitation for September, October, and November, 1887, 6.47, is 2.58 below the average of the corresponding period of the last five years.

Riley, McHenry Co., Ill.: the precipitation for the autumn of 1887, 9.23, is 0.73 above the normal of the corresponding period of the last twenty-six years.

HAIL.

Hail fell at scattering stations, mostly in the Northern States and territories, during the month on the following dates: 1st, 8th to 12th, 14th, 17th, 19th, 20th, 23d to 28th, 30th.

SLEET.

Sleet fell at scattering stations, mostly in the Northern States and territories, during the month on the following dates: 1st, 5th, 7th to 10th, 11th to 20th, 22d to 28th, 30th. It most frequently occurred from the 22d to the 28th.

SNOW.

Snow fell in the Northern States and territories on numerous dates during the month. South of the thirty-fifth parallel snow was reported by but three stations, viz.: Whipple Barracks, Ariz., 25th; Willcox, Ariz., 26th, and Abilene, Tex., 27th. At Lincolnton, N. C. (Lat. 35° 29′), about half an inch of snow fell on the 2d, and light snow fell on the 8th.

MONTHLY SNOWFALLS (in inches and tenths).

The following stations report monthly snowfalls of five inches or more; but in states having less, the maximum amount is also given:

California: Cisco, 16; Emigrant Gap and Summit, 15; Towles, 9; Halleck, 6. ***Colorado:*** Grand Junction, 5.5. ***Connecticut:*** North Colebrook, 4.3. ***Dakota:*** Richardton, 5.2; Deadwood, 5. ***Illinois:*** Lake Forest, 6; Aurora, 5.6; Riley, 5.5; Wheeling and Beason, 5. ***Indiana:*** Rushville, 11.8; Logansport, 6.8; Worthington, 6; Mauzy and Vevay, 5.5; Muncie, 5. ***Iowa:*** Cresco, 9.5; Independence, 6; Logan, 5. ***Kansas:*** Oberlin, 7; Kirwin, 5. ***Kentucky:*** Bowling Green, 4.8. ***Maine:*** Mayfield, 4.5. ***Massachusetts:*** Dudley, 5. ***Michigan:*** Calumet, 33.1; Marquette, 28.1; Sault Sainte Marie, 21.1; Central Mine, 21; Alpena, 13.7; Alma, 11.8; Mackinaw City, 10.9; Hillman and Gaylord, 10; Fletcher and Benzonia, 8.5; Harrisville, 7.5; Lansing (State Capitol) and Hastings, 7; Jonesville, Buchanan, and Greenville, 6.5; Traverse City, Ovid, Snowflake, and Saginaw, 6; Grand Rapids, 5.9; Mio, 5.8; Saint Johns and West Branch, 5.5; Escanaba, 5. ***Minnesota:*** Redwood Falls, 32; Minneapolis, 7.9. ***Montana:*** Fort Maginnis, 14.2. ***Nebraska:*** North Platte, 6.8; Genoa, 5. ***New Hampshire:*** Berlin Mills, 23; West Milan, 19; Stratford, 13; Shelburne, 12. ***Nevada:*** Beowawe, 5. ***New York:*** Utica, 17; Palermo, 16.2; Oswego and Cooperstown, 13; Worcester, 10.5; Friendship, 10; Le Roy, 9; Humphrey, 8.8; Buffalo, 8.3; Auburn, 8. ***Ohio:*** Kenton, 23.3; Jefferson, 12; Georgetown, 10; Yellow Springs, 9.6; Jacksonborough and Bangorville, 9; Cleveland *a*, 8.9; Tiffin, 8.5; Mansfield, Westerville, and Ohio State University, 8; Cleveland *b*, 7.5; North Lewisburg, Ruggles, Celina, and Hiram, 7; Garrettsville, 6.8; Wooster and McConnellsville, 6.5; Canton, Sidney, Clarksville, and Hanging Rock, 6; Dayton, 5.8; Oberlin, 5.3; Waverly, 5.2; New Athens, Greenville, and Akron, 5. ***Pennsylvania:*** Erie, 10; Meadville, 7; Grampian Hills, 5.5; Dyberry, 5. ***Utah:*** Kelton, 4. ***Vermont:*** Charlotte, 25; Northfield, 24.3; Strafford, 20; Burlington, Newport, and Chelsea, 19; Lunenburg, 14; Woodstock, 9; Manchester, 8.8. ***West Virginia:*** Middlebrook, 8. ***Wisconsin:*** Chippewa Falls, 30; Rhinelander, 16; Green Bay, 15.3; Fond du Lac, 11; Embarras, 10.5; Portage, 9; La Crosse, 7.7; Manitowoc, 7; Franklin and Phillips, 6; Delavan, 5.2; Lancaster, 5. ***Wyoming:*** Cheyenne, 3.

DATES OF FIRST SNOWFALL WINTER OF 1887–1888.

The first snowfalls of the season reported from various selected stations in the country are as follows:

Arizona: Fort Apache, October 8th; Whipple Barracks, November 25th; Willcox, November 26th. Arkansas: Lead Hill, November 27th. Colorado: Denver, October 7th; Fort Lewis, October 8th. Connecticut: North Colebrook, October 12th; Voluntown, October 21st. Dakota: Deadwood, September 12th; Fort Buford, October 7th; Yankton, October 23d. District of Columbia: Washington City, November 11th. Idaho: Fort Sherman, October 26th. Illinois: Cairo, November 27th; Chicago, October 21st; Rockford, October 22d. Indiana: Jeffersonville, November 19th; Logansport, November 21st; Terre Haute, November 29th. Indian Territory: Fort Reno, October 24th; Fort Supply, November 23d. Iowa: Cresco, October 22d; Keokuk, October 29th; Monticello, October 22d. Kansas: Dodge City and Leavenworth, November 23d; Concordia, November 25th. Kentucky: Bowling Green, November 27th; Elkin, November 26th; Frankfort, November 19th. Maine:

Bar Harbor, October 12th; Eastport, November 5th; Orono, October 30th; Portland, November 11th. Maryland: Fallston, November 18th; New Midway, November 19th. Massachusetts: Boston, New Bedford, and Williamstown, November 11th. Michigan: Detroit, October 21st; Fort Brady and Marquette, October 11th; Minnesota: Duluth, October 20th; Saint Paul, October 22d; Saint Vincent, October 10th. Missouri: Conception and Lamar, November 26th; Saint Louis, November 27th. Montana: Fort Assinaboine and Fort Custer, October 7th; Helena, October 6th. Nebraska: North Platte, October 24th; Omaha, October 23d; Valentine, October 22d. Nevada: Fort McDermitt, November 15th; Winnemucca, October 7th. New Hampshire: Berlin Mills and Nashua, November 11th; Wolfborough, November 10th. New Jersey: Dover and Egg Harbor City, November 11th; New Brunswick, October 25th. New Mexico: Fort Wingate, November 23d; Gallinas Spring, November 22d; Santa Fé, November 26th. New York: Buffalo, October 29th; New York City, November 11th; Plattsburg Barracks, November 10th. North Carolina: Charlotte, October 31st; Lincolnton, November 2d; Raleigh, October 31st. Ohio: Cleveland, Sandusky, and Toledo, October 21st. Oregon: Fort Klamath, October 6th; Portland, November 24th. Pennsylvania: Erie, October 21st; Philadelphia, November 11th; Pittsburg, October 21st. Rhode Island: Block Island, November 11th. Tennessee: Ashwood and Milan, November 27th; Chattanooga, October 30th. Texas: Abilene, November 27th; Fort Elliott, November 23d. Utah: Frisco, October 6th; Salt Lake City, November 17th. Vermont: Newport, November 10th; Northfield, October 22d. Virginia: Dale Enterprise, November 11th; Marion, November 19th. Washington Territory: Spokane Falls and Walla Walla, November 24th. Wisconsin: Delavan and Milwaukee, October 21st; Embarras, October 23d. Wyoming: Cheyenne, September 12th; Fort Bridger, October 6th.

DEPTH OF UNMELTED SNOW ON GROUND AT END OF MONTH.

[*Expressed in inches and tenths.*]

California: Fort Bidwell, 3. Colorado: Grand Junction, 3; Las Animas, 1; Colorado Springs, 0.2. Dakota: Parkston, 4; Richardton, 3; Fort Buford, 2; Deadwood and Fort Sully, 1; Yankton, 0.7; Fort Totten, 0.5; Bismarck, 0.2. Illinois: Belvidere, 2; Lake Forest, 1; Aurora and Cairo, 0.5; Chicago, Oswego, Riley, Springfield, Albion, Jacksonville, McLeansborough, and Wheeling, trace. Indiana: Butlerville, Sunman, and Vevay, 2; Indianapolis, 0.6. Iowa: Dubuque, 4.5; Cedar Rapids *b*, 2.5; Independence, 2 to 4; Cedar Rapids *a*, 1.5; Oskaloosa *b*, 1.2; Albia, 1; Oskaloosa *a*, drifts; Bancroft, Clinton, and Des Moines, trace. Kansas: Concordia, 2; East Norway, 0.5 to 2; West Leavenworth, 0.5; Wakefield, trace. Kentucky: Elkin, 3; Lexington, 1.4; Louisville, 0.2. Massachusetts: Williamstown, 1. Michigan: Central Mine, 21; Calumet, 16; Sault Sainte Marie, 14; Marquette, 10; Benzonia, 7; Gaylord, 6; Snowflake, 3.5; Escanaba and West Branch, 3; Fletcher, 2.5; Mackinaw City and Traverse City, 2; Greenville, 0.5; Alpena, 0.1; Grand Haven, trace. Minnesota: Minneapolis, 7; Saint Paul, 3; Saint Vincent, 2; Moorhead, 0.8. Montana: Fort Assinaboine, 4; Poplar River, 1.6; Helena, 1; Fort Maginnis, 0.5. Nebraska: Valentine, 2.6; Genoa and Hay Springs, 2; Kimball, North Platte, and Omaha, 1; De Soto, 0.2; Crete, trace. New York: Oswego, 4.5; Utica, 2.2; Auburn, Cooperstown, and Humphrey, 2; Ithaca, 1; Albany, Buffalo, and Menands, trace. Ohio: Cleveland *a*, 6; Cleveland *b*, Ruggles, and Yellow Springs, 4; Jacksonburg, Portsmouth, and Westerville, 3; Tiffin, 2.5; College Hill, Garrettsville, and Sandusky, 2; Cincinnati and Columbus, 1; New Athens, 0.5. Pennsylvania: Erie, 3; Wellsborough, trace. Utah: Frisco, 1. Vermont: Lunenburg and Northfield, 2; Manchester and Strafford, 1. Washington Territory: Spokane Falls, 0.7. West Virginia: Middlebrook, trace. Wisconsin: Embarras, 6; Fond du Lac and Green Bay, 5; Madison, 3; La Crosse and Prairie du Chien, 2; Manitowoc, 1.5. Wyoming: Fort Bridger, 0.4.

Excessive precipitation for the month of November, 1887.

States and stations.	Monthly, 6 inches, or more.	Specially heavy. 2 inches, or more, per day. Am't.	Duration.	Date.	At rate of inch, or more, per hour. Am't.	Duration.	Date.
Arkansas.			h. m.			h. m.	
Little Rock		2.05	24 00	23, 24			
British Columbia.							
New Westminster	9.00	2.29		9			
Do		2.13		13			
Illinois.							
Vandalia	8.95	5.00		26			
Pana	7.58	3.25		26			
Irishtown	7.45	2.63		27			
Jordan's Grove	7.09	3.25		27			
Charleston	7.06	5.21	32 00	26, 27			
Mattoon	6.84	5.11		26			
Paris	6.47	2.00		26			
Greenville	6.38	3.40		26			
Mascoutah	6.34						
New Athens	6.25						
Windsor		2.73		26			
Flora		2.29		26			
Indiana.							
Marengo	6.90						
Rockville		2.40		?			
Logansport		2.20		27			
Louisiana.							
Shreveport		2.90	24 00	24, 25			
Michigan.							
Central Mine	6.36						
Mottville					1.02	1 00	27
Mississippi.							
Biloxi		3.25	4 00	9			
Missouri.							
Forest Park		2.04	*	26			
Saint Louis		2.32	24 00	26			
Ohio.							
New Bremen		2.10		26			
Oregon.							
Astoria	8.11	2.26		8, 9			
Bandon	6.57	2.41		28, 29			
Yaquima L. H	6.06	2.63		8			
Astoria		2.26		8, 9			
Texas.							
Corsicana		3.62	32 30	23, 24, 25			
Do		2.00	2 00	26	2.00	2 00	26
Virginia.							
Cape Henry		2.15		10, 11			
Washington Territory.							
Tatoosh Island	10.15						
Fort Canby	7.25						

*Less than 19 hours.

Table showing the occurrence in the month of November of monthly precipitation of 10 inches, or more; precipitation equaling or exceeding 2.50 inches in 24 hours; and rains of one inch, or more, in one hour.

States and stations.	Rainfall of 10 inches, or more, per month. Year.	Amt.	Rainfall of 2.50 inches, or more, in 24 hours. Day.	Year.	Amt.	Rainfall equaling or exceeding one inch per hour. Day.	Year.	Time	Amt.
Alabama.		*Inches*			*Inches*			h. m.	*Inches*
Livingston	1880	10.54							
Mobile			8	1872	3.11				
Do			16	1876	2.53				
Do			20	1877	2.50				
Do			25	1878	3.40				
Do			6	1881	4.50				
Montgomery			8	1873	2.97				
Do			26	1878	2.65				
Arkansas.									
Fort Smith			9-10	1883	2.56				
California.									
Red Bluff	1885	17.05	3	1882	2.88				
Sacramento	1885	11.34	17	1885	4.29				
San Francisco	1885	11.78	22-23	1874	2.84				
Do			23	1874	3.98				
Do			23-24	1874	3.08				
Do			24	1885	2.58				
San Luis Obispo	1885	12.90							
Connecticut.									
New Haven			10	1875	2.93				
New London			6-7	1872	3.76				
Florida.									
Jacksonville			27-28	1884	3.75				
Key West			4	1884	3.51				
Pensacola	1885	11.07	6	1881	3.54				
Do			23	1884	3.21				
Do			6	1885	2.69				
Georgia.									
Atlanta			26-27	1878	2.65				
Augusta			6-7	1873	2.64				
Ellerslie	1880	12.60							
Illinois.									
Cairo			21-22	1874	2.52				
Do			22-23	1875	2.74				
Chicago			11-12	1881	3.38				
Do			5-6	1883	3.39				
Peoria			26	1858	3.40				

Table showing the occurrence, &c—Continued.

States and stations.	Rainfall of 10 inches, or more, per month.		Rainfall of 2.50 inches, or more, in 24 hours.			Rainfall equaling or exceeding one inch per hour.			
	Year.	Amt.	Day.	Year.	Amt.	Day.	Year.	Time	Amt.
Indiana.		*Inches.*			*Inches*			*h. m.*	*Inches*
Indianapolis			18	1881	4.30	18	1881	1 00	1.00
Do			21	1883	3.71	21	1883	1 00	1.50
Iowa.									
Des Moines			11-12	1879	2.84				
Onawa			17	1886	4.50				
Kansas.									
Leavenworth			1	1876	2.81				
Do			8	1879	2.56				
Do			11	1879	2.58				
Do			11	1881	3.10				
Louisiana.									
New Orleans			12-13	1871	2.80				
Do			4-5	1873	2.61				
Do			2	1876	2.61				
Do			6	1881	2.99				
Point Pleasant	1877	20.89							
Do	1880	19.52							
Shreveport			22	1873	4.00				
Do			8	1881	2.50				
Do			10	1883	4.83				
Do			23	1887	2.90				
Maine.									
Portland			15-16	1871	2.69				
Do			24-25	1871	2.70				
Do			26-27	1883	2.65				
Baltimore, *Maryland.*			24	1877	2.85				
Massachusetts.									
Boston	1876	11.03	15	1871	3.00				
Do			17-18	1873	3.45				
Do			20-21	1876	5.43				
Do			25-26	1877	2.93				
Do			18	1878	3.09				
Wood's Holl	1876	11.70							
Mississippi.									
Starkville			27	1882	2.55				
Vicksburg	1880	14.15	1	1877	2.50	28	1879	1.20	1.81
Do	1883	11.53	7-8	1877	2.83				
Do			24-25	1880	3.18				
Do			28	1880	2.93				
Do			11	1881	3.32				
Do			10-11	1883	4.79				
Do			22	1883	4.02				
Missouri.									
Saint Louis			17-18	1881	2.99				
New Hampshire.									
Mount Washington	1877	17.55	23-24	1884	3.30				
Do	1881	15.10							
New York.									
Buffalo			14-15	1871	2.53				
New York City			6-7	1872	2.83				
North Carolina.									
Hatteras	1880	12.68							
Do	1884	13.02	15	1880	3.10	24	1877	1 00	1.00
Do			28	1882	2.99				
Do			26	1883	3.12				
Do			16	1884	3.80				
Kitty Hawk			28	1882	2.87				
Do			16	1884	4.04				
Raleigh			1	1887	4.52				
Statesville						28	1877	1 00	1.20
Ohio.									
Columbus			18-19	1881	2.95				
Toledo			13-14	1871	2.68				
Oregon.									
Astoria	1885	12.45							
Bandon	1885	18.21							
Eola	1877	13.01							
Portland	1874	10.22	27	1883	3.62				
Do	1875	15.77							
Do	1876	10.03							
Do	1877	12.45							
Roseburg			6-7	1885	3.58				
Pennsylvania.									
Philadelphia			19-20	1876	2.59				
South Carolina.									
Charleston			8	1877	4.17				
Do			18-19	1879	3.58				
Tennessee.									
Chattanooga			22	1883	3.00				
Knoxville			16-17	1873	2.55	30	1880	0 55	1.05
Do			22-23	1874	2.54				
Do			25-26	1878	2.79				
Do			22-23	1883	2.65				
Do			6-7	1885	3.14				
Texas.									
Brownsville			13	1882	2.60	2	1873	0 30	3.50
Galveston			12-13	1871	2.67	5	1877	0 15	1.48
Do			6	1872	5.63				
Do			19	1877	2.53				
Do			22	1884	2.51				
New Ulm	1873	14.93							
Palestine			25-26	1882	2.95	10	1883	0 50	2.18
Do			10	1883	5.05				
Do			3-4	1885	2.51				
San Antonio						27	1887	1 00	1.30
Lynchburg, *Virginia*			22	1877	4.23				
Washington.									
Canby, Fort	1885	13.72							
Neah Bay	1885	19.60							
Olympia	1877	19.88	15-16	1878	3.24				
Do	1878	11.09							
Do	1885	10.18							
Pysht	1885	13.07							
Tatoosh Island	1885	19.25	27-28	1883	4.49				
Do	1886	10.44							

HEAVY RAINFALLS AT WASHINGTON CITY.

In connection with a request from the superintendent of sewers for certain information regarding rainfall in Washington City, a considerable amount of data has been gathered, a partial discussion of which may be of interest to engineers throughout the country. The observations cover a period of seventeen years (less one month), from January, 1871, to November 30, 1887; in which time rain or melted snow has been recorded 1,543 times. The rainfall has exceeded one inch one hundred and ninety-two times, or almost exactly once in eight times. On thirty-seven different occasions (about 2½ per cent.) the amount of rain during the storm has equaled or exceeded two inches. Rainfalls exceeding two inches occurred four times in August, and six times each in June, July, September, and October; while they were rare in other months; none at all having been observed in February. The heaviest rainfall from a single storm was 5.80 inches in nineteen hours on July 29th and 30th, 1878.

Of equal and perhaps greater importance than the amount recorded during a single storm, is the rate which falls in any single hour. Assuming that a less rate than one inch per hour is not especially important, examination was confined to those cases in which the rate was greater. Sixteen cases have occurred, as shown in the table below:

Heaviest falls of rain at Washington City, from January, 1871, to November, 1887, inclusive.

Date.	Amount.	Time.	Rate of fall.	
			Per hour.	Maximum at any time.
	Inches.	*h. m.*	*Inches.*	*Inches.*
July 3, 1871	1.13	0 30	2.26	2.26
July 18, 1871	0.83	0 20	2.49	2.49
September 25, 1872	1.50	1 00	1.50	8.00
August 18, 1875	1.20	1 00	1.20	2.40
August 29, 1875	1.30	1 00	1.30	1.30
October 23, 1875	1.40	1 00	1.40	2.50
June 22, 1877	1.08	1 00	1.08	2.00
July 28, 1877	1.20	1 00	1.20	3.00
July 29, 1877	1.42	0 26	3.24	3.24
October 4, 1877	1.49	1 00	1.49	6.00
July 2, 1884	1.12	1 00	1.12	3.00
November 24, 1884	1.00	1 00	1.00	2.00
July 26, 1885	0.96	0 06	9.60	9.60
October 29, 1885	1.20	1 00	1.20	2.40
June 24, 1886	1.10	1 00	1.10	3.00
July 26, 1886	1.80	1 00	1.80	6.00

Thus it appears that on two occasions, September 25, 1872, and October 4, 1877, 1.50 inches fell in one hour.

Perhaps, however, the more important and destructive results followed from the storm on July 26, 1886, when a rainfall of 1.80 inches occurred in one hour.

An examination of the records of the self-registering rain gauge proved that the rate of rainfall for short periods of time far exceeds the rate per hour. As, for instance, on October 4, 1877, and July 26, 1886, the rate equaled six inches per hour, and on September 25, 1872, eight inches per hour. The maximum rate recorded, however, was the extraordinary one of 9.60 per hour, which occurred on July 26, 1885, when .96 inch of rain fell in six minutes.

It is possible that these data may be of marked value to engineers in showing that the occasions are very rare in Washington, and probably in adjacent cities, when more than an inch and a quarter of rain may be expected within an hour.

DROUGHT.

In addition to the data given in previous REVIEWS concerning the protracted drought of 1887, the following table has been prepared, showing the normal precipitation for the period from March 1st to November 30th, also that for the corresponding period of the current year, with the departures, etc., at certain Signal Service stations in the region most seriously affected by the drought:

Precipitation from March to November—Signal Service observations.

Stations.	Normal.	Total for 1887.	Comparison of 1887 with the normal.	Percentage of normal rainfall for the months.
	Inches.	*Inches.*	*Inches.*	*Per cent.*
Atlanta, Ga	39.8	37.4	— 2.4	94
Cairo, Ill	33.2	15.1	—18.1	45
Chattanooga, Tenn	41.0	33.9	— 8.1	80
Chicago, Ill	30.3	17.2	—13.1	57
Cincinnati, Ohio	31.3	23.6	— 7.7	75
Cleveland, Ohio	29.7	23.5	— 6.2	79
Columbus, Ohio	32.1	19.5	—12.6	61
Des Moines, Iowa	33.7	20.7	—13.0	61
Detroit, Mich	26.7	21.1	— 5.6	79
Dubuque, Iowa	33.3	24.3	— 9.0	73
Escanaba, Mich	30.1	16.6	—13.5	55
Fort Smith, Ark	30.4	29.2	— 1.2	93
Galveston, Tex	41.2	30.0	—11.2	73
Grand Haven, Mich	30.4	20.0	—10.4	66
Indianapolis, Ind	35.3	22.5	—12.8	64
Keokuk, Iowa	31.5	17.0	—14.5	54
Knoxville, Tenn	39.0	28.8	—10.2	74
La Crosse, Wis	28.4	14.5	—13.9	51
Leavenworth, Kans	34.0	31.3	— 2.7	92
Little Rock, Ark	38.2	22.7	—15.5	59
Louisville, Ky	34.9	23.4	—11.5	67
Memphis, Tenn	39.5	23.3	—16.2	59
Milwaukee, Wis	17.6	19.8	+ 2.2	111
Mobile, Ala	50.2	35.1	—15.1	70
Montgomery, Ala	38.4	23.9	—14.5	62
Nashville, Tenn	37.0	29.5	— 7.5	80
New Orleans, La	49.0	47.5	— 1.5	97
Omaha, Nebr	33.3	17.2	—16.1	52
Pensacola, Fla	50.3	38.2	—12.1	76
Pittsburg, Pa	27.8	31.6	+ 3.8	114
Port Huron, Mich	26.7	15.7	—11.0	59
Saint Louis, Mo	33.0	27.4	— 5.6	83
Saint Paul, Minn	25.6	21.7	— 3.9	85
Sandusky, Ohio	29.5	17.9	—11.6	61
Shreveport, La	38.9	28.8	—10.1	77
Springfield, Ill	32.5	16.0	—16.5	49
Toledo, Ohio	26.2	20.2	— 6.0	77
Vicksburg, Miss	43.2	27.5	—15.7	64
Yankton, Dak	26.6	24.0	— 2.6	90

A chart based upon data contained in the above table shows that over nearly the whole region extending from the Great Lakes to the Gulf between the eighty-second and ninety-fifth meridians the rainfall during the period from March 1 to November 30, 1887, did not exceed 80 per cent. of the normal, except over a small area at the mouth of the Mississippi. Over a large portion of the region named the percentage of precipitation falls to 60, and over a considerable area in southern Illinois only about 50 per cent. of the normal precipitation fell during the period mentioned.

The following notes on drought during November and preceding months have been received:

Little Rock, Ark, 4th: rain is badly needed in all sections of the state; wells are becoming dry and cattle suffering for water.

Paris, Monroe Co., Mo., 9th: light rain, the first for several weeks, during the night of the 8–9th; streams are nearly dry and water is very scarce. Typhoid fever prevailing in this section is attributed to the use of impure water.

Marshall, Saline Co., Mo.: the heavy rain on the 9th was greatly needed throughout this county. Ponds were nearly dry, and stock suffered for water.

Carbondale, Jackson Co., Ill.: the rain of the 9th was of great benefit as it broke the drought and put out the forest fires which had been burning in this and adjoining counties for several days.

Centralia, Marion Co., Ill: the protracted drought in this vicinity was broken by the rain of the 9th; the scarcity of water caused much inconvenience.

Nashville, Tenn., 18th: severe drought is prevailing over the entire state; only 0.45 inch of rain has fallen at this station since October 25th.

The observer at Sunman, Ripley Co., Ind., reports: "The rains from the 22d to the 27th terminated the severest drought of the last fifty years."

Charleston, Coles Co., Ill.: on the 22d the creeks were all dry, cisterns and wells nearly exhausted, and cattle suffering for water; on this date rain began and continued until the 27th; during the last two days of the storm 5.21 inches of rain fell.

Milan, Gibson Co., Tenn.: the protracted drought was broken on the 23d; streams and wells had dried up, and water had to be hauled long distances.

Laconia, Harrison Co., Ind.: the rain of the 23d replenished cisterns, ponds, etc. The Ohio River at this place was lower than known for past forty years.

Rev. T. H. Sonnedecker, Tiffin, Ohio, reports as follows: "The long and memorable drought was broken by the rains from the 24th to 27th. A special feature of the drought of November, 1887, is that old settlers say that it was the most severe of any in their recollection. Wheat has suffered severely; many wells which were never dry before and cisterns which were never empty failed, so that farmers were obliged to dig their wells much deeper or drive their stock three to five miles for water. A water train loaded at the Baltimore and Ohio Railroad well connecting with the Sandusky River was run from this city to different points, almost daily, to supply engines, or for household use."

Mottville, Saint Joseph Co., Mich.: the drought was partly relieved by the rains from the 24th to the 27th; winter wheat has been greatly retarded.

Wauseon, Fulton, Co., Ohio: the long and disastrous drought was broken by the rains from the 24th to the 27th.

The Saint Louis, Mo., "Post-Dispatch" of the 24th contained the following:

"CHESTER, ILL., *November* 24.—Reports from all sections of the state show that refreshing rains fell throughout yesterday, notably at Mt. Vernon, Ramsey, Greenville, Centralia, Vandalia, Marion, Fairfield, Murphysborough, McLeansborough, Hillsborough, Marshall, and Duquoin.

"ELGIN, Ill., *November* 24.—The entire season of 1887 throughout the dairy district of this portion of Illinois has been unfavorable not only regarding dairy, but general farming. The fall of rain was light and winter set in without the usual fall rains, consequently, in many instances, there is a scarcity of water for stock. Again, owing to the drought, all kinds of grain were a light crop, and hay a complete failure. Farmers have to buy more or less grain for their dairy cattle each year, but this season many have to buy all their feed. There is no suffering of stock for lack of water.

"PIEDMONT, Mo., *November* 24.—A fine rain fell last night, with about two inches by the water-gauge.

"HERMANN, Mo., *November* 24.—The drought has affected the growing wheat very injuriously. Last Saturday we had a northern blizzard, very cold, and the wind traveling at a fearful velocity, which was more detrimental to the wheat than the drought. Stock water, and with many families water for ordinary and other purposes, had to be hauled from the river or some creek and has caused the farmers great inconvenience. The drought has so completely withered and dried up the grass and the deposit of leaves from the trees has been so heavy that forest fires have prevailed and inflicted great damage. Tuesday night there was a gentle rain, and last evening there was a slight fall, which is very grateful to vegetation and elates the hearts of the farmers. Wheat has been so damaged that only the most favorable weather from this to harvest will insure near a full crop."

Carmi, White Co., Ill.: the rain of the 26th ended the protracted drought and extinguished the forest fires which had been burning in this vicinity.

Windsor, Shelby Co., Ill., 27th: the drought which has prevailed during the past two months has been broken by three days' rain.

Cairo, Ill., 28th: the late rains have broken the drought in this vicinity, which had become very severe. Over a large area there has been little or no rain since the beginning of July. The rivers have continued at a low stage longer than ever known since any systematic gauging of the western rivers was begun. The Ohio River is so low that navigation, except for the smallest of boats (which are ordinarily used on the small tributaries), is practically suspended. The crops were below the average and the supply of water scant, the bad condition of the latter causing much sickness.

Livingston, Sumter Co., Ala.: November has been one of the dryest months on record here, the total precipitation, 0.35 inch, fell on one day, the 28th.

Middlebrook, Randolph Co., W. Va., 30th: the drought continues, though somewhat relieved by the November rains. The mills are still without water.

Dale Enterprise, Rockingham Co., Va., 30th: the effect of the drought has been severely felt in the lack of water for stock; the streams are very low.

Elk Falls, Elk Co., Kans., 30th: the month has been very dry and water is scarce, the main supply has to be hauled from Elk River.

Mr. Wm. Dozier, Mattoon, Coles Co., Ill., reports as follows:

"MATTOON, ILL., *December* 10, 1887.—From June 1st to November 23d—175 days—we had 145 dry days and only 9½ inches of rain, during the 175 days. We had on the 4th and 11th of August 2¼ inches of rain, and 2¼ inches the last week in September, therefore having only 4¾ inches in all the rest of the period of 175 days. The 4¾ inches of rain occurred on 30 different days strung along the 175 days in showers of only a few drops, and at no time over ½ inch; and at no period of the 175 days were there more than two weeks without rain at all. The temperature in the shade by standard thermometers (the kind used by the United States Signal Service) during the summer season of 1887 was above 100° on 17 different days, and above 90° on 59 different days. The highest being 108°, on July 29th and 30th (highest in the sun, 124°). The season was only about 18 per cent. cloudy. The excessive heat and much sunshine a large portion of the 175 days would dry up a quarter or half inch shower in a few hours and the few drop showers almost instantly. Such a heated season would require about 7 inches more rain than other seasons, whereas we had only one-fourth the rainfall required to make a good crop season. The rainfall during one-half of the 11 days immediately following November 23d was nearly equal to that of the 175 days—being 8½ inches (5 inches on November 26th)."

Mr. John S. Seely, of Oswego, Kendall Co., Ill., in a communication to the Chief Signal Officer, dated December 19, 1887, reports as follows:

"It is easy to see why our crops have been poor this year; to date we have had but 25.16 inches of rainfall; in January and February we had 7.27 inches, which all ran off because the ground was frozen; from March to July, inclusive, 5.56 inches was all we had to do grain and hay crops any good; what we had in August and September, 6.18 inches, helped the fall feed and winter grain, but the ground was so parched that it made but little growth in comparison to what it would have done had the ground been in fair condition. The rains since October have been of but little benefit for this year. The weather has been so mild that the rain we have had has gone into the ground and will help next year, but we had not near enough. Water is still scarce. Records show that the rainfall has gradually diminished since 1882. The showers this season appeared to go around us; at Aurora, six miles north, more rain fell than at this place, and the same may be said of other localities, but none had a surplus."

Mr. B. F. Ferris, Sunman, Ind., reports as follows: "The severity of the drought was not altogether due to the deficiency of the rainfall, but was in a great measure intensified by the action of two other causes operating in conjunction with that. These were the high temperature of the three summer months and the unusual light character of the rains throughout the year. Upon comparing this with other years during which we have been taking daily observations for the Signal Service, we find that although the rainfall was considerably less than that of 1885 and 1886 (3.15 and 5.70 inches, respectively), it was 5.55 more than that of 1884. The mean temperature of the summer of 1887 was 77°.1, 4° higher than 1885 and 1886, and 1°.3 higher than 1884. The rains of the current year have all been very light, so that but very little of it penetrated to any considerable depth but was confined to the surface, and was evaporated by the intense heat. At no time during the summer was the soil saturated so as to prevent ploughing immediately after rain had ceased."

WINDS.

The most frequent directions of the wind during November, 1887, are shown on chart ii, by arrows flying with the wind. Over the northern districts east of the Rocky Mountains the prevailing winds were generally from west and northwest; in the lower Ohio and central Mississippi valleys, southerly; in other districts, variable.

HIGH WINDS (in miles per hour).

The maximum velocities of wind for November, 1887, at Signal Service stations where the movements are registered, are given in the table of miscellaneous meteorological data. Other than the maximum velocities given in this table, but two stations report velocities of 50 or more miles per hour, viz.: Fort Canby, Wash., 60, se., 8th; 60, s., 9th; 60, s., 10th; 60, s., 12th; 68, s., 13th; 54, s., 27th; Valentine, Nebr., 50, nw., 19th.

LOCAL STORMS.

Cairo, Ill.: a thunder-storm, with high westerly winds, began 4.05 and ended 6.35 p. m. on the 9th; at 4.30 an unusual electrical phenomenon occurred in the form of a ball of lightning, which exploded with a terrific report when in altitude 40° in the northeast quadrant.

Butlerville, Jennings Co., Ind.: a severe wind storm set in at 9.15 a. m. on the 19th; at 10.40 a. m. it became so dark that ordinary work could not be carried on without artificial light; the darkness cleared away at 12.30 p. m.

Fort Custer, Mont.: a severe wind storm prevailed from 2.45 until 6.40 p. m. on the 12th; maximum velocity, sixty miles per hour from the northwest, was recorded at 4.15 p. m.

Vevay, Switzerland Co., Ind.: a fierce gale from west began 10 a. m. of the 19th, scattering every movable object before it; the rough and turbulent condition of the Ohio River rendered its crossing and navigation in general impossible; the dark and gloomy atmosphere enveloped everything in darkness, and common print could not be distinguished; the gale continued throughout the day and the following night.

Key West, Fla.: the severe wind storm which began on the afternoon of the 20th attained its maximum velocity, thirty-six miles per hour, at 6.05 a. m. on the following date and ended 7.48 a. m.

Duquoin, Perry Co., Ill.: an unusually severe storm, for this season of the year, occurred during the night of the 26–27th; it was accompanied by loud thunder and vivid lightning.

Galveston, Tex., 28th: a report from Mineola, Wood Co., Tex., states that during the night of the 26–27th a severe storm occurred at that place. One building was blown down and several persons were killed.

INLAND NAVIGATION.

STAGE OF WATER IN RIVERS AND HARBORS.

In the following table are shown the danger-points at the various stations and the highest and lowest depths for November, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, November, 1887 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
Red River:						
Shreveport, La	29.9	1	11.5	24	3.4	8.1
Arkansas River:						
Fort Smith, Ark	22.0	29	1.8	22, 23, 24	0.8	1.0
Little Rock, Ark	23.0	1	2.0	21, 22, 23	1.1	0.9
Missouri River:						
Omaha, Nebr	18.0	1, 2, 4, 5, 10, 11	5.7	22	5.3	0.4
Leavenworth, Kans	20.0	13, 14	7.1	30	3.9	3.2
Mississippi River:						
Saint Paul, Minn	14.5	14	1.9	22, 23	0.8	1.1
La Crosse, Wis *	24.0	1–9	3.0	27	2.1	0.9
Dubuque, Iowa	16.0	1	3.1	30	1.9	1.2
Davenport, Iowa	15.0					
Keokuk, Iowa	14.0	1	1.9	29	— 0.5	2.4
Saint Louis, Mo	32.0	1	5.6	30	4.4	1.2
Cairo, Ill	40.0	4, 5	3.5	19, 20	2.1	1.4
Memphis, Tenn	34.0	6, 7, 8, 9	3.2	18–23	2.2	1.0
Vicksburg, Miss	41.0	1	— 2.0	24, 25	— 3.9	1.9
New Orleans, La	13.0	9	3.0	17	1.3	1.7
Ohio River:						
Pittsburg, Pa	22.0	29	6.7	25	5.1	1.6
Cincinnati, Ohio	50.0	28	5.1	21–24	2.8	2.3
Louisville, Ky	25.0	30	3.3	6, 7	2.3	1.0
Cumberland River:						
Nashville, Tenn	40.0	30	0.6	23, 24	— 0.2	0.8
Tennessee River:						
Chattanooga, Tenn	33.0	1	3.0	25, 26, 27	1.4	1.6
Monongahela River:						
Pittsburg, Pa	29.0	29	6.7	25	5.1	1.6
Savannah River:						
Augusta, Ga	32.0	1	8.0	20, 29, 30	6.1	1.9
Sacramento River:						
Red Bluff, Cal		13	0.9	4, 17–21, 24, 28	0.5	0.4
Sacramento, Cal		15–25	7.6	1–12	7.2	0.4
Willamette River:						
Portland, Oregon		16	4.4	27	0.6	3.8

*27 days; river frozen after 27th.

ICE IN RIVERS AND HARBORS.

Mississippi River.—Saint Paul, Minn.: an ice-dam formed in the river at this point on the 28th.

La Crosse, Wis.: the river was full of floating ice on the 20th and 23d. The last boat of the season arrived on the 25th; the river froze over on the 28th.

Dubuque, Iowa: the last boat of the season arrived on the 9th; navigation closed after that date. The river froze over on the 28th.

Keokuk, Iowa: the navigation closed on the 21st, steamers "Natrona" and "Dexter" being the last boats of the season.

Missouri River.—Fort Buford, Dak.: navigation closed on the 10th and the river froze over on the 24th.

Fort Yates, Dak.: the river froze over on the 27th.

Omaha, Nebr.: the river froze over on the 20th.

Leavenworth, Kans.: the river was full of floating ice during the 26th.

Grand River.—Lansing, Mich.: the river froze over on the 20th; ice broke on the 24th; river froze over again on the 28th.

Thunder Bay River.—Alpena, Mich.: the river froze over on the 30th.

Devil's Lake.—Fort Totten, Dak.: navigation closed on the 18th; the steamer "Minnie H." made her last trip of the season on this date; the lake froze over on the 22d.

Laramie and Platte Rivers.—Fort Laramie, Wyo.: these rivers froze over on the 26th.

Fox River and Green Bay.—Green Bay, Wis.: the river froze over on the 24th; Green Bay froze over on the 25th; steamer "De Pere" from Chicago was unable to reach port on this date on account of ice and was compelled to put back.

Hudson River.—Albany, N. Y.: there was floating ice in the river on the 22d.

Rock River.—Beloit, Rock Co., Wis.: the river froze over on the 28th.

Rockford, Winnebago Co., Ill.: the river froze over on the 21st; the ice broke up and moved out on the 26th and the river froze over again on the 28th.

Duluth Bay.—Duluth, Minn.: the bay froze over on the 25th; navigation closed on the 27th.

HIGH TIDES.

Chicamicomico, N. C.: high tide occurred on the 2d, causing some damage to telegraph lines.

High tide also occurred at this station on the 30th; and at Duke, Fla., 30th.

ATMOSPHERIC ELECTRICITY.

AURORAS.

Auroras were observed during the month as follows: 8th, Cornish, Eastport, Gardiner, Kent's Hill, and Orono, Me.; Nashua, N. H.; Plattsburg Barracks, N. Y.; Burlington and Northfield, Vt. 9th, Cornish, Eastport, and Kent's Hill, Me.; North Truro, Mass. 12th and 13th, Kent's Hill, Me. 14th, Wytheville, Va. 15th, Nashua, N. H.; Variety Mills, Va. 17th, Fort Sully, Dak.; Orono, Me. 18th, Kent's Hill, Me. 19th, Bismarck and Webster, Dak.; Duluth, Moorhead, and Saint Vincent, Minn. 20th, Fort Sully and Webster, Dak. 21st, Fort Sully and Huron, Dak. 22d, Fort Sully, Dak.

THUNDER-STORMS.

Thunder-storms were reported as follows:

4th, Sacramento and Willows, Cal. 5th, Vashon, Wash. 8th, Key West, Fla.; Emporia, Fort Hays, Globe, Leavenworth, Lebo, Wakefield, Ninnescah, and Yates Centre, Kans.; Lamar and Springfield, Mo.; De Soto, Nebr. 9th, Butlerville, Sunman, and Vevay, Ind.; Fort Gibson, Ind. T.; Fort Madison and Keokuk, Iowa; Leavenworth, Kans.; Louisville, Ky.; Fayette, Saint Louis, and Forest Park, Mo.; Cincinnati, College Hill, Columbus, and Yellow Springs, Ohio; Milan, Tenn. 10th, Albia, Iowa; Cleveland, Ohio. 11th, Albany and Yaquima Light House, Oregon; Corpus Christi, Tex.; Blakely, Fort Canby, Olympia, Port Angeles, and Pysht, Wash. 13th, Archer, Fla.; Moorhead, Minn. 14th, Titusville, Fla.; Dover, N. J.; Syracuse, N. Y.; Southport, N. C.; Stateburg, S. C.; Macon, and Lynchburg, Va. 15th, Lynchburg, Va. 18th, Archer and Cedar Keys, Fla.; Quitman, Ga. 19th, Archer, Fla.; Oskaloosa, Iowa; Wilmington, N. C.; Variety Mills, Va. 23d, Yuma, Ariz.; Lead Hill and Little Rock, Ark.; Cairo, Ill.; Corsicana, Palestine, and San Antonio, Tex. 24th, Utica, N. Y.; Fort Concho, Cleburne, and Abilene, Tex. 25th, Fort Niobrara, Nebr.; Cedar Hill, Tex. 26th, Lead Hill, Ark.; Jacksonville and Springfield, Ill.; Indianapolis, Ind.; Dubuque, Iowa; Frankford, Forest Park, and Springfield, Mo.; Fort Niobrara, Nebr.; Cedar Hill, Cleburne, Corsicana, Decatur, Mesquite, Palestine, and San Antonio, Tex. 27th, Cairo, Ill.; State College, Pa. 28th, Nashua, N. H., State College, Pa. 30th, Las Vegas, N. Mex.

MISCELLANEOUS PHENOMENA.

FOREST AND PRAIRIE FIRES.

Owing to the dry weather of November and previous months in the Mississippi, Missouri, and Ohio valleys, forest fires have been very prevalent, especially during November. The loss of much property has resulted, and at times navigation on rivers has been rendered dangerous on account of the prevalence of dense smoke. The following are some of the many reports which have reached this office concerning these fires:

Butlerville, Jennings Co., Ind.: extensive forest fires prevailed in this county from the 3d to the 8th, doing much damage to fences and timber.

Little Rock, Ark.: very extensive forest fires were raging throughout the state from the 5th to 7th, 12th to 15th, and from the 18th to 22d, causing much damage to crops and fences; the smoke was so dense that at times it was impossible to see objects one hundred yards distant.

Cairo, Ill.: dense smoke overspread this region during the 5th, caused by extensive fires in what is known as the "cypress swamps" in Missouri; the fires reached from Commerce, Mo., thirty-five miles north of Cairo, to New Madrid, seventy-five miles to the southward of this city. In the surrounding country the fires have spread rapidly through "Cashe" bottom until the greater part of its area has been swept by the flames. The smoke was so dense after 6 p. m. that the navigation on the rivers was partially suspended for a distance of forty miles along the Ohio River and for one hundred miles along the Mississippi River. Similar conditions prevailed on the 6th, 7th, and 8th; on the last date the fires reached what is known as the "Island," to the northeast of the city, and extended along the trestle of the Mobile and Ohio Railroad. On the 11th the forest fires were still burning in many places, though not so widespread as previously, rains having checked them somewhat, and the smoke did not interfere with navigation. On the 15th the fires again increased and light smoke prevailed during the entire day and night; on this date the transfer steamers were retarded in making their trips on account of smoke, and like conditions prevailed on the 16th, 17th, 18th, 21st, and 22d. The forest fires were extinguished by the snow on the 28th.

Bismarck, Dak.: extensive prairie fires were observed in the north on the 4th and 5th, and in the northeast and south on the 6th.

Fort Yates, Dak.: extensive prairie fires occurred to the west and northwest of station on the 5th, 6th, and 16th.

Fort Supply, Ind. T.: large prairie fires were raging south of this place on the 6th.

Valentine, Cherry Co., Nebr.: large prairie fires occurred about ten miles southwest of this place on the evening of the 6th.

Middlebrook, Randolph Co., W. Va.: the atmosphere was very smoky on the 7th, due to extensive forest fires which were burning about six miles west of this place.

Erie, Pa.: the forest fires in this section were extinguished by the rain of the 10th, on which date the air was filled with smoke from the smothered fires.

Memphis, Tenn.: during the 15th, 16th, and 17th the atmosphere was filled with dense smoke from forest fires in Arkansas; the rain of the 25th is reported to have subdued the fires.

Milan, Gibson Co., Tenn., 16th: the surrounding country has been enveloped in smoke since the 4th, caused by fires; farmers have sustained heavy losses.

Grand Haven, Mich.: several forest fires started east of this place on the 16th and made considerable progress; by the 18th the fires were burning fiercely over an area of about three miles, but the rain and snow on the 19th quenched the flames.

Shreveport, La.: extensive forest fires prevailed in Bosier parish, northeast of this city, on the 18th; reports from the burning district received on the 19th stated that several houses and barns had been destroyed.

Nashville, Tenn., 18th: destructive forest fires have prevailed in southwest Tennessee and Arkansas during the past five days, and on this date are still raging fiercely; many houses and much valuable stock and timber have been destroyed by the flames.

Louisville, Ky.: the atmosphere was filled with smoke during the 18th, caused by forest fires which were burning to the south of this city. On the morning of the 19th it was so dark as to render artificial light necessary.

Laconia, Harrison Co., Ind.: owing to forest fires in various localities and the high westerly winds on the 19th the smoke became so dense as to cause darkness to such a degree that it was difficult to see even a short distance, and steamers on the Ohio River were compelled to stop running at midday. Forest fires were of almost daily occurrence prior to the 23d, several houses, barns, fences, and much timber were burned; the rain which fell on the 23d soon checked the progress of the fires.

Lamar, Mo.: forest fires occurred on the 18th and 19th to the west of this place; the telegraph poles were burned, interrupting communication.

Oxford, Miss., 20th: the smoky condition of the atmosphere during the past few days was due to forest fires in western Tennessee and eastern Arkansas.

Fort Smith, Ark.: the atmosphere on the 21st was filled with smoke from extensive forest fires in the adjoining states.

Springfield, Mo., 22d: dense smoke has enveloped this section during the past few days, due to the extensive forest fires which have prevailed south of this city.

Lead Hill, Boone Co., Ark., 30th: dense smoke from forest fires filled the air on the 5th, 13th, 18th, 21st, 22d, and 23d; it is reported that several farm houses were burned and much other damage done by forest fires in various sections of the state.

Wauseon, Fulton Co., Ohio, 30th: the prairies about five miles southwest of here were on fire during the greater part of the month; forest fires prevailed about the 15th in the timber lands fifteen miles northeast of this place.

METEORS.

Meteors were observed as follows:

1st, Crete, Nebr. 2d, Cedar Rapids, Iowa. 3d, Cedar Rapids, Iowa; Woodstock, Md.; Utica, N. Y. 4th, Lead Hill, Ark.; Fort Maginnis, Mont. 5th, Vevay, Ind.; Cleburne, Tex. 6th, Boisé City, Idaho; Nashua, N. H.; Clayton and Dover, N. J. 7th, Fort Sully, Dak.; Humphrey, N. Y. 8th, Fort Sully, Dak.; Utica, N. Y. 9th, Cedar Keys, Fla.; Cedar Rapids, Iowa. 10th, Lead Hill, Ark.; Fort Sully, Dak.; Cairo, Ill.; Woodstock, Md.; Crete, Nebr.; Stateburg, S. C.; Cleburne, Tex. 11th, Fort Sully, Dak.; Vevay, Ind.; Wakefield, Kans.; Wauseon, Ohio. 12th, Cedar Keys, Fla.; Savannah, Ga.; Wakefield, Kans.; Wauseon, Ohio. 13th, Fort Sully, Dak.; Wilson, Kans.; Biloxi, Miss.; Beverly, N. J. 14th, Lead Hill, Ark.; Fort Sully, Dak. 15th, Woodstock, Md.; Springfield, Mo. 16th, Yuma, Ariz.; Fort Sully, Dak.; Vevay, Ind.; Yates Centre, Kans.; Egg Harbor City, N. J.; Yaquima Light House, Oregon. 17th, Yuma, Ariz.; Vevay, Ind.; Dover and Egg Harbor City, N. J.; Quakertown, Pa.; New Ulm, Tex. 18th, Bar Harbor, Me.; Taunton, Mass.; Ardenia and Utica, N. Y. 19th, Moorhead, Minn.; Wakefield, Kans. 22d, Taunton, Mass.; Cedar Spring, S. C.; New Ulm, Tex. 25th, Savannah, Ga. 27th, Utica, N. Y. 29th and 30th, Humphrey, N. Y.

MIGRATION OF BIRDS.

Geese flying southward—Red Bluff, Cal., 1st to 4th, 6th, 12th, 15th; Fort Sully, Dak., 3d; Fort Sill, Ind. T., 17th, 26th; Fort Madison, Iowa, 14th; Globe, Kans., 4th, 8th; Wellington, Kans., 4th; Yates Centre, Kans., 24th; Shreveport, La., 17th; Somerset, Mass., 24th, 25th; Mottville, Mich., 13th, 14th; Forest Park, Mo., 24th; Brownville, Nebr., 27th; North Platte, Nebr., 4th; Manchester, N. H., 25th; Boyd's Corners, N. Y., 26th; Palermo, N. Y., 1st, 6th; Albany, Oregon, 5th, 13th, 14th; East Portland, Oregon, 16th; Linkville, Oregon, 1st, 2d, 7th to 16th, 20th, 23d, 24th to 29th; Roseburg, Oregon, 1st, 5th, 11th, 13th, 14th; Austin, Tenn., 13th; Corsicana and Fort Elliott, Tex., 4th; Palestine, Tex., 9th; Green Bay, Wis., 23d.

Geese flying northward.—Fort Madison, Iowa, 15th, 23d; North Platte, Nebr., 3d; East Portland, Oregon, 15th.

Ducks flying southward.—Duke, Fla., and Springfield, Mo., 29th; Green Bay, Wis., 25th.

MIRAGE.

Mirages occurred as follows: Yuma, Ariz., 6th, 8th; New London, Conn., 29th, 30th; Parkston, Dak., 11th, 16th, 21st; Webster, Dak., 11th, 15th, 27th; Cedar Keys, Fla., 10th, 11th; Marquette, Nebr., 1st, 3d, 10th to 12th, 28th; Galveston, Tex., 1st, 2d.

SAND STORMS.

Forest Park (near Saint Louis), Mo.: a severe sand storm prevailed all day of the 19th, the wind attained a maximum velocity of sixty miles per hour.

Sand storms also occurred as follows: Willcox, Ariz., and Keeler, Cal., 10th.

SUN SPOTS.

Mr. H. D. Gowey, North Lewisburg, Champaign Co., Ohio, observed sun spots as follows: 5th, 6th, 12th to 17th.

VERIFICATIONS.

INDICATIONS FOR 33 HOURS IN ADVANCE.

The detailed comparison of the tri-daily indications for November, 1887, with the telegraphic reports for the succeeding thirty-three hours, shows the general average percentage of verifications to be 81.42. The percentages for the different elements are: Weather, 86.09; wind, 78.50; temperature, 76.31. By states, etc., the percentages are: For Maine, 80.30; New Hampshire, 78.90; Vermont, 78.00; Massachusetts, 80.57; Rhode Island, 81.10; Connecticut, 82.87; eastern New York, 84.00; western New York, 77.53; eastern Pennsylvania, 80.90; western Pennsylvania, 80.97; New Jersey, 80.77; Delaware, 80.73; Maryland, 84.23; District of Columbia, 80.70; Virginia, 83.77; North Carolina, 83.03; South Carolina, 82.87; Georgia, 83.93; eastern Florida, 81.87; western Florida, 78.20; Alabama, 81.50; Mississippi, 85.62; Louisiana, 82.85; eastern Texas, 81.35; Arkansas, 84.10; Tennessee, 84.03; Kentucky, 83.17; Ohio, 80.53; West Virginia, 83.97; Indiana, 82.17; Illinois, 82.43; lower Michigan, 74.00; upper Michigan, 75.78; Wisconsin, 80.14; *Minnesota, 70.67; Iowa, 82.00; Kansas, 85.57; Nebraska, 77.53; Missouri, 84.17; Colorado, 80.21; *eastern Dakota, 72.52; *southern California, 76.18; *northern California, 80.32; *Oregon, 70.80; *Washington, 70.83.

The predictions for all districts east of the Rocky Mountains, for November, 1887, were made by 1st Lieutenant H. H. C. Dunwoody, 4th Artillery, U. S. Army, Acting Signal Officer and Assistant, except those for Minnesota and eastern Dakota, which were made at Saint Paul, Minn., by 1st Lieutenant Thomas M. Woodruff, 5th Infantry, U. S. Army, Acting Signal Officer and Assistant, and those for the Pacific coast districts, were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps, Assistant; the verifications for all districts were determined by 1st Lieutenant Robert Craig, 4th Artillery, U. S. Army, Acting Signal Officer and Assistant.

CAUTIONARY SIGNALS.

Of the total number of cautionary and storm signals ordered during November, 1887, it was practicable to determine the justification or failure of one hundred and nine; justified, eighty-nine, or 81.65 per cent. Of the above, seventy-six were ordered for cautionary signals; number justified, sixty-three, or 82.29 per cent. Thirty-three storm signals were ordered; number justified, twenty-six, or 78.79 per cent. Total number of direction signals ordered, ninety-four; justified, ninety-one, or 96.81 per cent. Number of signals ordered for easterly winds, eighteen; justified, seventeen, or 94.44 per cent. Number of signals ordered for westerly winds, seventy-six; justified, seventy-four, or 97.37 per cent. Number of storms without signals, eight. Number of signals ordered late, *i. e.*, after justifying velocity had begun, fourteen, or 12.84 per cent.

COLD-WAVE SIGNALS.

Total number of cold-wave signals ordered, one hundred and ninety-one; justified, one hundred and fifty-three, or 80.10 per cent. Eight cold-wave signals were ordered during the month by the Signal Service Officer at Saint Paul, Minn., of which, seven, or 87.50 per cent., were justified.

LOCAL VERIFICATIONS.

The following is from the report of the "Michigan State Weather Service" for November, 1887:

Weather and temperature signals are now displayed in one hundred and thirty-eight towns in the state, and on the baggage-cars of twenty-six trains on eight principal railroads of the state.

The percentage of verification of weather signals for November is as follows (the verification is taken from reports of displaymen furnished this office monthly): temperature, 82.2 per cent.; weather, 85.4 per cent.; temperature and weather, 83.8 per cent.

The percentage of verification of weather predictions for November on the D., G. H., and M. R'y., is 84.3 for weather and 86.7 for temperature; on the C. & G. T. R'y., weather, 79.8, and temperature, 75.3; P. H. & N. W. R'y., weather, 81.7, and temperature, 79.7; M. C. R'y, for weather, 80.3, and for temperature, 84.0; G. R. & I. R'y, weather, 80.0, and temperature, 77.7; C. & W. M. R'y, weather, 82.3, and temperature, 80.0.

The following is from the November, 1887, report of the "South Carolina Weather Service."

The percentage of the verification of the weather and temperature predictions for the state was: for weather, 85.2 per cent.; temperature, 89.4 per cent. per cent.

*In determining the general average percentage and the percentages for the different elements, Minnesota, eastern Dakota, and the Pacific coast states have not been included.

The following is from the "Tennessee State Board of Health Bulletin" for November, 1887:

The percentage of verification of weather and temperature predictions, furnished daily from the Signal Office at Washington to the various stations in the state during the month, was for the state: weather, 92.3 per cent.; and temperature, 85.9 per cent.

ERRATA.

October, 1887, REVIEW, on page 281, in the table of "Deviations from the average precipitation," the heading of the third column, Total for October, 1877, should read Total for October, 1887. Same REVIEW, on page 295, in the "Table of miscellaneous meteorological data," in the column of elevations above sea-level, Tatoosh Island, 860 feet, should read 86 feet.

STATE WEATHER SERVICES.

The following extracts are republished from reports for November, 1887, of the directors of the various state weather services:

The "Alabama Weather Service," P. H. Mell, jr., of the Agricultural and Mechanical College, Auburn, director:

The weather during most of the month has been pleasant, and unusually mild for a winter season. The condition of the atmosphere has been fine for gathering the cotton remaining in the fields, and specially favorable for all the work required on the farm. The dry season has kept the roads in good traveling condition throughout the state.

Although the average temperature for the month was 2°.5 below the normal, still there were so many mild periods that the casual observer might overlook the few cold days that reduced the temperature below the normal. Killing frosts occurred in middle and south Alabama on the mornings of the 21st and 22d; in the extreme northern portions of the state killing frosts came as early as the 1st and 2d. There were two severe cold waves that swept across the state, the first on the 20th, the second on the 28th. The first was the most severe.

The rainfall was 3.28 inches below the normal.

The autumn just closed gives a temperature 3°.4 below the normal, the average for the period being 62°.9. There was also quite a deficiency in the amount of rainfall during the three months. The total precipitation was 7.48 inches; 3.91 inches below the normal.

Summary.

Atmospheric pressure (in inches).—Monthly mean, 30.164; maximum observed, 30.68, at Auburn, on the 30th; minimum observed, 29.60, at Chattanooga, on the 19th; range for state, 1.08.

Temperature (in degrees Fahr.).—Monthly mean, 52°.9; highest monthly mean, 59°, at Oswichee; lowest monthly mean, 42°.1, at Demopolis; maximum, 84°, at Union Springs, on 1st; minimum, 9°, at Gadsden, on the 21st; range for state, 75°; greatest local monthly range, 69°, at Gadsden; least local monthly range, 37°, at Fayette.

Precipitation, including melted snow (in inches).—Average for the state, 1.12; greatest, 6.00, at Fayette; least, inappreciable, at Newton.

Winds.—Prevailing direction, northeast.

The "Monthly Review of the Illinois Weather Service," Col. Charles F. Mills, director:

The drought of this remarkable season continued until the 23d, when copious rains set in and continued at intervals until the morning of the 27th, thereby removing the water famine that seemed so imminent. No rain fell until the 9th, when there was slight rain over the greater part of the state—more copious in the northern counties than either the central or southern. On the 19th there was a considerable snowfall in the northern counties, with light rain in a few of the central, but none in the southern. Although rain fell on fewer days in the southern than in the northern division, the precipitation in the latter was only one-third that of the former. Still considerable rain fell all over the state, but in some places there were remarkable downpours for this period of the year. At Vandalia, 5 inches fell on the 26th; Greenville, 3.40; Mattoon, 5.11; Pana, 3.25; Jordan's Grove, 3.25; Irishtown, 2.63; Saint Louis, 2.32, and Flora, 2.29. The heaviest rainfall of the month was at Vandalia, 8.95 inches, nearly all of which fell on three days; the least was 0.70 of an inch, at Ashland.

There was hardly any precipitation in this state until the 23d, when light rain began and continued at intervals until the 26th, when it changed to snow before the advancing "cold wave," and ended on the morning of the 27th. This rain was the first break in the drought of the season and has been of considerable benefit generally, especially to growing wheat and the wells that have been so long dry. Still the relief is only temporary, and much more is needed.

A record at this office of the annual rainfall in the state since 1840, a period of forty-six (?) years, shows that the average is 38.41 inches. The present year up to date falls about 18 inches below this; consequently, this year will be remarkable as the driest on record, for there is no probability that December will make up beyond a small fraction of this deficiency. There have been other years in which drought prevailed since the record commenced, but none anywhere approaching this. The greatest rainfall recorded since 1840 was 48.49 inches, in 1852, which was 10.17 above the general average of forty-six years; 1844 was next, with 48.17 inches; 1851 had 46.91; and 1862 had 46.30. The driest year was 1867, with 29.53 inches, which was nearly nine inches below the general level. Other dry years were 1870, with 29.90 inches; 1854, with 31.13; and 1856, with 31.89. The present year will therefore in all probability, fall five or six inches below the lowest on record.

The average temperature for November, 40°.2, was one degree above the average of twelve years, and 2°.5 below the mean of November 1882, which was the highest during that period. The average for the northern division was 36°.2; for the central, 40°.4, and for the southern, 44°.1. The warmest day was the 3d, and the coldest was the 28th. On that day the temperature was recorded below zero in nineteen counties in the northern division, while three others recorded zero.

The "Indiana Weather Service," Prof. H. A. Huston, of Purdue University, Lafayette, director:

The mean temperature was slightly above the normal for six years, and slightly below the normal for fifteen years. Great changes from a higher to a lower occurred about the 20th and 28th, while the highest temperature everywhere in the state occurred on the 3d. The precipitation during the month was slightly in excess. The drought was ended about the 23d by steady rains, followed by snow, falling everywhere till the 27th; the deficiency since January 1, 1887, which on the 22d had reached 15.38 inches, was considerably lessened thereby. Hoar frost was very frequent, and snow fell everywhere in the state near the end of the month.

Summary.

Temperature (in degrees Fahr.).—Monthly mean, 39.4; highest monthly mean, 49.3, at Worthington; lowest monthly mean, 34.4, at Mauzy; maximum, 80.0, at Marengo on the 3d; minimum, —7.0, at Worthington, on the 28th; range for state, 68.3; greatest local monthly range, 82.0, at Worthington, least local monthly range, 55.0, at Angola.

Precipitation, including melted snow (in inches).—Average for the state, 3.97; greatest, 6.90, at Marengo; least, 1.43, at Crawfordsville.

Wind.—Prevailing direction, southwest.

The "Kansas Weather Service," Prof. J. T. Lovewell, Topeka, director:

The temperature for this month is from 1° to 3° above the normal. Two warm and two cold waves have passed over the state during the month. The precipitation, as usual for the season, has been light and below the normal for the month, the greater amount fell during the storm of the 7–9th, and the balance from the 23d to the 26th.

Summary.

Temperature (in degrees Fahr.).—Monthly mean, 41.5; highest monthly mean, 49, at Sedan; lowest monthly mean, 35, at Eustis; maximum, 87, at Lebo, on the 3d; minimum, —19, at Eustis, on the 27th; range for state, 106; greatest local monthly range, 100, at Eustis; least local monthly range, 75, at Sedan; greatest daily range, 52, at Lebo, on the 3d; least daily range, 3, at Leavenworth, on the 25th.

Precipitation, including melted snow (in inches).—Average for the state, .90; greatest, 1.40, at Cawker City and Lawrence; least, .24, at Dodge City.

Wind.—Prevailing direction, south.

The "Louisiana State Weather Service," in charge of R. E. Kerkam, Sergeant, Signal Corps, at New Orleans:

The mean temperature of the state for November, 1887, was 57°.5, which was 0°.3 above the normal for the month. The means of the northern section, 55°.7, and of the southern section, 59°.3, were respectively 1°.3 below and 1°.8 above the November normals for those sections. The daily mean temperature of the state ranged from 56° to 67° from the 1st to the 18th of the month, and fell from 67° on the 16th to 39° on the 20th, when it rose to 70° on the 26th, falling to 40° on the 28th; the month closing with a daily mean of 50°. With the exception of the two cold waves mentioned the past month was remarkably mild and pleasant.

The maximum temperature observed, 81°, occurred in Madison parish on the 15th, and the range of the maximum temperatures reported was only 5°, the lowest, 76°, being reported from Saint Tammany parish on the 8th, 24th, and 26th. The minimum temperatures were reported on the 21st and 28–29th, and, excepting Novembers of 1877 and 1880, when minimum temperatures of 19° and 18°, respectively, were recorded in Caddo parish, the minimum of the past month is the lowest on record for the state, being 22°, and reported from Delta, Madison parish.

The average precipitation for the state, 1.93 inches, was 2.03 inches below the November normal, and the lowest on record for the month. The extremes of monthly rainfall reported were, 5.45 inches from the 23d to 25th, inclusive, and 0.52 of an inch in Orleans parish. The average number of clear days was 15; fair, 8; cloudy, 7; and on which appreciable precipitation fell, 4. From this it appears that the state received about 10 per cent. more sunshine during the past month than in the average November. The prevailing winds in the northern section were from the south, and in the southern section from the north.

The "Michigan Crop Report" (the state weather service is in charge of N. B. Conger, Sergeant, Signal Corps, at Lansing):

The meteorological features of the state are based upon reports received from seventy voluntary observers and eight of the United States Signal Service.

The month has been characterized by two areas of pressure, one low area on the 18th and 19th, and a high area which passed off on the 30th. The temperature has been but 0°.7 below the the normal of fifteen years for the state. The precipitation is below the normal about one-half inch for the month.

Temperature (*in degrees Fahr.*).—The mean monthly temperature, 34.9, is 0.7 below the normal. The temperature was below the normal 3.3 in the Upper Peninsula, 2.5 in the northern section, 0.1 in the central section, and 0.3 in the southern section. The highest mean daily temperature, 52, occurred on the 7th, and the lowest, 14, on the 28th. The highest daily temperature at any station, 56, occurred at Coldwater, Jonesville, and Marshall, on the 7th, and the lowest, —7.0, at Lothrop, on the 28th. Mean range of temperature for the state, 55.4.

Two cold waves passed during the month, for which signals were displayed from twenty-four to thirty hours in advance. The first passed on the 20th, there being a fall of from 15° to 20°, and the second on the 27th and 28th; the average fall for this wave was 35° throughout the state.

Precipitation (*in inches and hundredths*).—The average monthly rainfall, 2.34, is 0.51 below the normal. The Upper Peninsula shows an excess of 0.47, while the northern section is below the normal 1.15, the central section 0.77, and the southern section 0.18. There was but little precipitation in the state until the 9th, but all above the southern section received precipitation on the 14th and 19th. The precipitation was general throughout the state on the 24th, 25th, 26th, and 27th, and the heaviest, which occurred on the 26th and 27th, will average more than one-half of the entire precipitation for the month. The greatest amount recorded at any one station was 1.82 on the 27th, at Petersburg, although greater amounts are recorded on the 26th and 27th. The average amount of snowfall for the month in the different sections is as follows: Upper Peninsula, 20.7; northern section, 7.1; central section, 5.7; southern section, 6.6. There were from 3 to 21 inches of snow on the ground at the end of the month in the Upper Peninsula; 2 to 7 in the northern section, and but a trace in localities in the central and southern sections. From March 1st to December 1st there has been a deficiency of rainfall of 7.56 for the entire state, the major portion of this deficiency occurring in the central and southern portions.

Summary.

Temperature (*in degrees Fahr.*).—Monthly mean, 34.9; highest monthly mean, 38.5, at Lansing and Marshall; lowest monthly mean, 28.0, at Sault Ste. Marie; maximum, 73.0, at Bad Axe, on the 7th; minimum, —7.4, at Escanaba, on the 29th; range for state, 80.4; greatest local monthly range, 21.4, at Corunna; least local monthly range, 11.1, at Mackinaw City; greatest daily range, 43.0, at Coldwater, on the 27th; least daily range, 1.4, at Saginaw, on the 25th.

Precipitation, including melted snow (*in inches*).—Average for the state, 2.34; greatest, 6.36, at Central Mine; least, 0.98, at Escanaba.

Wind.—Prevailing direction, southwest.

The "Missouri Weather Service," Prof. Francis E. Nipher, of Washington University, Saint Louis, director:

Temperature.—The average temperature for the state was 43°.0. The average of maximum was 77°.6, and the average of minimum 5°.1, making an average range of 72°.5. The highest temperature reported was 81°.8, on the 2d, at Fayette, and the lowest —9°.5, on the 27th, at Oregon, this being the lowest November temperature observed at Oregon for thirty-two years. This makes a range of 91°.3 for the state during November. The greatest local monthly range was 89°.5, at Oregon, and the least monthly range was 63°.9, at the central station.

Rainfall (*in inches*).—The rain was quite evenly distributed over the state; the greatest having fallen in the east-central section, and the least in the north and west sections of the state. The average rainfall for the month was 2.72 inches. The greatest rainfall was, 6.34 inches, at Mascoutah, Ill., and the least, 0.63, at Kirksville, Mo.

The "Nebraska Weather Service," Prof. Goodwin D. Swezey, of Doane College, Crete, director:

The month of November has been one of prevailing pleasant weather, but with a few days of extreme temperatures both high and low. The precipitation has been normal, occurring almost wholly as snow in one or two slight falls.

Precipitation.—The snowfall over the state has shown little unevenness in distribution. Only a few stations report over an inch of precipitation, this area lying along the lower Platte and stretching up the Missouri. The greater part of the state was visited by but one slight fall of snow from the 23d to the 25th, although an earlier and heavier fall occurred in the eastern portion on the 8th and 9th.

Temperature.—The most notable feature of the month was the unusually early occurrence of a severe cold wave, which was observed in the regions north of Montana on the 25th, and extended southward and eastward over all states and territories east of the Rocky Mountains by the 29th, causing the temperature to fall below freezing in the central portion of the Gulf and south Atlantic states. The changes in temperature attending this cold wave ranged from 40° to 50° within twenty-four hours in the central valleys on the 27th and 28th. At Hay Springs the temperature fell from a maximum of 26° on the 25th to a minimum of —26° on the 27th; and at Valentine from 29°.2 to —31°.5, a range of over 60°. The mean temperature of the month has been 36°.7, which is only a trifle above the normal; the highest temperature was 87°, which exceeds by over 12° any previous November maximum for ten years; the minimum, —31°.5, was lower by about 25° than during the past ten Novembers; only twice, indeed, has November given temperatures below zero.

The "New England Meteorological Society," Prof. Wm. H. Niles, of the Institute of Technology, Boston, Massachusetts, president:

Reports for the month were received from one hundred and fifty-four observers.

The month, as a whole, was normal in temperature, with a deficiency in precipitation. The former would have been in excess but for the strong cold-wave at the close of the month.

Summary.

Atmospheric pressure (*in inches*).—Monthly mean, 30.00 (seventeen stations); maximum observed, 30.92, at Northfield, on the 30th; minimum observed, 29.10, at Portland, on the 11th; range for New England, 1.82; greatest local monthly range, 1.76, at Portland; least local monthly range, 1.42, at Nantucket.

Temperature (*in degrees Fahr.*).—Monthly mean, 37.7 (one hundred and eight stations); highest monthly mean, 45.3, at Block Island; lowest monthly mean, 31, at Berlin Mills; maximum, 75, at Olneyville, on the 27th; minimum, —7, at Berlin Mills, on the 29th; range for New England, 82; greatest local monthly range, 76, at Berlin Mills; least local monthly range, 32, at Nantucket; greatest daily range, 55, at Berlin Mills, on the 29th; least daily range, 2, at Woonsocket, on the 15th; Hartford, 16th; Middletown, 25th; Waterbury, 28th.

Precipitation, including melted snow (*in inches.*)—Average for New England, 3.13 (one hundred and thirty-three stations); greatest, 5.65, at Manchester, Vt.; least, 1.62, at Dalton.

Wind.—Prevailing direction, northwest (fourteen stations).

The "New Jersey Weather Service," Prof. George H. Cook, of the Agricultural College, New Brunswick, director:

Summary.

Mean temperature, 41°; highest temperature, 67°.6, on the 27th; lowest temperature, 20°.9, on the 30th; absolute range of temperature, 46°.7; greatest daily range of temperature, 33°.8, on the 4th; least daily range of temperature, 8°.1, on the 15th; mean daily range of temperature, 17°.4; mean daily dew-point, 34°.9; mean daily relative humidity, 80.7 per cent.

Total precipitation, 2.35 inches. Number of days on which .01 inch or more of precipitation fell, 7; number of clear days, 10; number of fair days, 14; number of cloudy days, 6.

The "North Carolina Weather Service," Dr. Herbert Battle, of Raleigh, director:

Temperature (*in degrees Fahr.*).—Monthly mean, 48; highest monthly mean, 51.9, at Wilmington; lowest monthly mean, 45.3, at Weldon; maximum, 77, at Marion, on the 4th; minimum, 12, at Marion and Hot Springs, on the 21st; range for state, 65; greatest local monthly range, 65, at Marion; least local monthly range, 41, at Salisbury.

Precipitation, including melted snow (*in inches*).—Average for the state, 1.09; greatest, 2.87, at Hatteras; least, 0.17, at Davidson College.

Wind.—Prevailing direction, southwest.

The "Ohio Meteorological Bureau," Prof. B. F. Thomas, of the Ohio State University, Columbus, president:

Temperature (*in degrees Fahr.*).—The mean temperature for the month was 39.3, or 0.9 below the mean for the past six years. The highest was 75, at Portsmouth, on the 26th, and the lowest, 8, at the Ohio State University and Westerville, on the 29th. This is the lowest temperature reported during November since 1880. The monthly range was 83; the mean daily range was 21.5; the greatest daily range was 48, at Logan, on the 6th, and the least, 2, at Hiram, on the 15th.

Precipitation (*in inches*).—The month opened with clear weather, and rain was not reported from any station until the 9th, on which date general, though mostly light, rains occurred. The precipitation continued through the 10th in all sections, and in the northern section on the 11th. It was in the form of snow in this section. The precipitation was general throughout the state on the 14th, 15th, 19th, 20th, 24th, 25th, 26th, 27th, and 28th. The greatest rainfall for twenty-four hours was 2.10, at New Bremen, on the 26th. The greatest monthly rainfall reported was 4.82, at New Bremen, and the least, 1.31, at Youngstown.

Snow.—Snow was reported from stations in the northern section on the 11th and 28th, and on the 19th, 20th and 27th, from all parts of the state.

Hail.—Hail was reported from Bangorville on the 15th.

Average number of clear days, 11.4; average number of fair days, 7.7; average number of cloudy days, 10.9; average number of days on which rain fell, 8.1; least number of days on which rain fell, 5, at Greenville, Celina, Napoleon; greatest number of days on which rain fell, 13, at Jefferson; mean monthly rainfall, 2.81 inches; average daily rainfall, .094 inch.

Prevailing direction of the wind, southwest.

"Oregon Weather Service," report prepared by B. S. Pague, Sergeant, Signal Corps:

Temperature (in degrees Fahr.).—At Roseburg the temperature was slightly above the normal and at the other stations slightly below; but at no station has there been any marked departure. The month was well divided into a warm and a cool period, the former extending from the 1st to the 15th, and the latter from the 16th to the end of the month. In general the highest temperature occurred on the 1st, and the lowest on the 25th. The highest reported in the state being 78, at Ashland, the lowest, 1, at La Grande. The mean of the state for the month is 41.

Precipitation (in inches).—The most marked feature of the state has been the deficiency in precipitation at all stations, except Albany and Bandon. The deficiency ranges from 3.34 at Portland to 0.80 at Linkville. The precipitation for the season, from July 1st, is most decidedly below the average in all sections of the state, Portland being the most deficient.

Weather.—But one general storm passed over the state; it appeared off the coast of Washington Territory on the 27th and rapidly extended to the south. From the 24th to the 28th the weather was unusually cold.

Winds.—The winds were variable and light to fresh in force.

Snow.—Although it is unusual for snow to fall so early in the season in the interior valleys a light snow was reported in Flournoy Valley, twelve miles west of Roseburg, on the 15th, also again on the 24th. Two inches of snow fell at East Portand on the 25th. Very light snow at Eola on the 23d; on the 24th a few flakes fell at Roseburg, and on the 29th snow fell at "The Dalles" and in the southern part of the state.

Frosts.—From the 1st to the 16th occasional frosts occurred, and from the 16th to the end of the month killing frosts occurred in all sections of the state.

The "Pennsylvania State Weather Service," report prepared under the direction of the Franklin Institute, Philadelphia, by Sergeant T. F. Townsend, Signal Corps, assistant:

The mean temperature of the state for November was 39°.2, which is about normal. The highest temperature occurred on the 27th, and ranged from 65° at Girardville and Dyberry to 79° at Washington. This extreme was followed by a cold wave on the 29th and 30th, during which the following low temperatures were noted: Wellsborough, 1°; Drifton, 6°; Clarion, 8°; State College, 8°.5; Greenville, 8°.4; Indiana, 9°, and Philadelphia, 25°. This cold wave was general throughout the United States, and low temperatures extended to the southern parts. One of its notable features was its slow progressive easterly movement after reaching the Alleghanies. The greatest daily ranges of temperature during the month occurred about the 2d, and the least daily ranges on the 11th, 15th, and 24th. Until the last of the month the ground was not frozen so as to seriously interfere with ploughing. Frosts were numerous and general. The average rainfall for the state was 1.80 inches, which is but little more than half of the usual quantity for November. The stations reporting the most are, Erie, 4.13 inches; Dyberry, 2.60 inches; Clarion, 2.45 inches; Indiana, 2.44 inches; Wysox and Greenville, each 2.38 inches. The least occurred at Charlesville, 0.90 inch, and Carlisle, 0.96 inch. The dates on which general rains occurred were the 10th, 11th, 14th, 15th, 19th, 20th, 24th, 25th, and 28th.

Much inconvenience has been experienced in many counties from the drought. In Clearfield and Luzerne counties streams and wells are reported very low. In Northumberland the scarcity of water has been severely felt at the collieries. During the entire month the fear of a water famine was general in Berks county. Farmers were hauling water in barrels for home use and cattle were driven daily to running streams, often long distances from home. Springs that were never known to fail ceased to flow. It is said that the Schuylkill has not been so low for many years. Much damage has been done throughout several counties by forest fires. Light snows prevailed throughout the state on the 10th, 11th, 19th, 20th, and 30th. The greatest depth reported was six inches at Scranton and Grampian Hills.

The following is an extract from the report of the "Meteorological Department of the State (Tennessee) Board of Health," prepared under direction of J. D. Plunkett, M. D., President of the State Board of Health, by H. C. Bate, Signal Corps, Assistant, Nashville:

The main features of the weather during the month of November were the small amount of rainfall, the almost entire absence of electrical disturbances, the large percentage of clear days, and the smoky atmosphere which prevailed during the second decade. The month taken altogether was remarkably pleasant.

The mean temperature was 47°.1, about the normal for November of the past five years. The highest temperature recorded was 80°, on the 4th, and the lowest, 10°, recorded on the 20th, 21st, and 28th, and was the lowest November minimum since 1883. The highest monthly mean was 62°.6, at Memphis, and the lowest, 32°.8 at Lawrenceburg. The daily ranges of temperature were generally much greater than usual, the greatest being the remarkable range of 51°, on the 27th, at Austin. During the month four cold-wave warnings were received, viz.: 17–18th, 19–20th, 23d–24th, 26–28th, all of which were fully verified, except the warning of the 23d, which did not materialize. There were two cold waves during the month for which no warnings were received, viz.: the 5–6th and 10–11th. In the first the temperature fell 30°, and in the second 27°.

The mean precipitation was 1.57 inches, much below the November normal, and the smallest November mean during the past five years, except in 1884, when it was about the same. Of this amount the eastern division received an average of only 0.75 inch, the middle division receiving a little less than an inch and a half, and the western division a little less than an inch and a half. In the eastern division only two stations reported as much as one inch, while at one station (Parksville) no rain was reported during the month. There were ten days on which a measurable quantity of rain fell. The greatest daily rainfall occurred on the 27th, and was, in most parts of the state, followed immediately by a fall of sleet and snow. The greatest monthly rainfall was 4.06 inches, reported at Memphis, and the greatest daily fall was 1.59 inches, on the 25th, also reported at Memphis, and 1.60 inches on the 26th, at Nunnelly. With the exception of the 7th, 9th, 10th, 14th, 23d, 24th, 25th, 26th, 27th, and 28th, no measurable rain or snow fell during the month. There was a very light fall of snow in the western part of middle division on the 20th.

The protracted drought was peculiarly favorable to the extensive forest fires, which prevailed to a greater or less extent over the entire state, but which were particularly prevalent in the western division, doing much damage. These fires caused a densely smoky atmosphere for more than a week, culminating on the 19th, when it was so dense that it became painful to the eyes and rendered breathing disagreeable. This day will long be remembered as the "smoky day." The cold wave which came on the 20th cleared the atmosphere.

Prevailing winds, north and east.

NOTES AND EXTRACTS.

RAIN AND SNOW FROM CLOUDLESS SKY.

[By Junior Professor T. RUSSELL, Signal Service.]

The 7 a. m. maps of the Signal Service have been examined for the weather conditions prevailing in the vicinities of places where rain or snow from a cloudless sky have been reported. Where the place happens to be a Signal Service station the rainfall during twenty-four hours at the place is always small, rarely exceeding 0.03 inch. But it does not follow that all of that very small amount fell from a cloudless sky. There may have been other rainfalls during the day. The maps almost invariably show rain or snow in the vicinities of these places at 7 a. m. More than half the cases were found to occur on the southwest side of an area of low barometer prevailing in some part of the country at the time, and at a distance of about 500 miles from its centre. In many cases where snow has been reported winds were sometimes as high as twenty-five miles per hour. As there has always been snow in the vicinities of the places, presumably from cloudy skies, this suggests that the snowfall from a cloudless sky may sometimes be snow carried in the upper air from a place where it is cloudy. Some of the cases of snow occur in areas of high barometer with light winds. In these the isothermal lines on the map are usually crowded in the vicinity of the place. Nine out of the eighty-one cases occurred at Burlington, Vt. This might be taken to indicate that the observer there takes a special interest in that class of occurrences and watches for them closely. Probably rain or snow from cloudless sky is a frequent occurrence at many places, but passes unnoticed.

It would seem as if rain or snow from a cloudless sky might occur at any time when a considerable volume of warm air saturated with moisture ascended and mixed with cooler air above, also saturated. Air mixing in this way, a fog or cloud would be formed which might disappear before the rain or snow reached the earth. The transition from cloud to rain would depend on the rapidity of mixing, and this would be greater, the greater the difference in temperature of the mixing volumes of air. A warm current of air above a cold one, if both were saturated, might cause a fall of rain without perceptible formation of cloud. The tendency of the clouds to mix would be caused by the friction of the currents on each other and the diffusion of moisture from the warmer to the colder current where it solidifies or liquifies. Ordinarily in the formation of cloud and rain the warm current is near the surface of the earth and the tendency to mix, which is caused by a difference in density, goes on through a great thickness of air as the warm currents ascend. The rainfall from a cloudless sky is always small. It would require mixing throughout a layer of air seventy feet thick and a reduction in its temperature from 80° Fahr. to 60° Fahr. at saturation to produce 0.01 inch of rainfall. But a fall of 0.002 inch of rain, lasting half a minute, would be very perceptible to a person out of doors, while not measurable with the ordinary rain-gauges in use. A much smaller amount of precipitation in the shape of snow would be very noticeable. One flake of snow to a cubic yard of air for a height of 200 yards for only five seconds would be a conspicuous snow storm, totally inappreciable as depth of rainfall.

Rain from a cloudless sky is frequently observed at Mauritius Island in the tropics. In the far north of the Arctic regions snow without clouds, or fine frost particles, as it is called, occurs almost daily.

In an area of low barometer or cyclone the rainfall extends principally in front, or to the east of the lowest barometer, and only a short distance back of it. The circulation of winds in a cyclone at the earth's surface is around the lowest barometer, contrary to the direction of motion of the hands of a

watch, and incurved towards the centre of the cyclone. In the upper air the motion is outcurved from the centre. Most of the rainfall in a cyclone comes down within a few miles of where it is formed in front of the lowest barometer. The farther back of the low area the thinner the vail of cloud. As most of the cases of rain or snow from cloudless skies occur on the southwest side of an area of low barometer the places where this occur may be the limiting line of rainfall in the cyclone and it may really be from cloud, but so thin as to be imperceptible, or so small in quantity as to have disappeared by the time the rain reaches the ground.

Table of monthly and annual mean temperatures at Hopkinton, Iowa, from January, 1852, to November, 1887, inclusive, from observations of Theodore Marks.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual mean.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1852	21	29	34	42	61	70	76	71	61	54	30	21	47·5
1853	20	21	34	47	58	73	71	74	65	49	38	25	48·5
1854	16	28	41	53	60	70	76	73	68	57	39	28	50·8
1855	24	19	31	**56**	63	68	73	70	66	49	39	20·5	49·1
1856	10	18	26	50	60·5	**74**	76	69	61	53	34	15	45·5
1857	**6.5**	26	30	**38**	56	68	74	69	65	50	31·5	**32**	45·8
1858	**32**	20	41	47	56	72	74	71	65	52	33	24	49
1859	21	26	41	43	63	66	76	72	63	49	40	15	48
1860	22	27	43	51	65	70	75	70	60	53	36	21	49·5
1861	17	23	34	51	56	71	71	72	62	52	36	30	48
1862	16	17	34	43	61	68	73	70	62	51	34	28	46·7
1863	27	24	33	50	61	66	70	69	62	45	35	24	47
1864	17	24	32	46	60	68	73	70	63	46	34	16	45·8
1865	17·3	28·3	31	46	60	69	**67.5**	71·3	**69.5**	50	40·7	19·7	47·5
1866	18	19	29·3	50	59	66	74	**66**	57·7	52·5	38·5	21·3	46
1867	14·7	24	**25**	45	**50.3**	70·3	72	73·5	66	54	**42.5**	23·5	46·7
1868	12	22	39	43	62	69	**80**	67	**57**	49·7	38	21	46·7
1869	28·7	27	30	47	59·3	66	71	72·5	62·5	**43.7**	33	27	47·2
1870	22·3	25	30·5	52	65·7	72	77·3	71	67	55	41·3	24·3	50·2
1871	22·5	28·3	39·7	52·7	65	72	74	73·7	62·3	54·3	32	17·7	48·7
1872	19·7	24·3	29	50·3	60	71·3	74·3	73	64	52·3	30·5	15·3	47
1873	14	18·3	34	45	59	73	72·3	74·7	60·3	47	32	27	46·7
1874	21·7	27	33	41	64·7	71	77	75	65	53·5	35	26	49·2
1875	7	**8.5**	29	47·3	61·5	67·3	74	71·3	63·7	49·5	35·5	32·7	45·5

Table of monthly and annual mean temperatures at Hopkinton, Iowa—Con.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual mean.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1876	27	28	30	49	61·7	68·7	74·3	74·7	62·3	49·5	34	**14.5**	48
1877	15·7	36	27	48·7	61·7	**63**	74	73	68	53	35	41·7	50
1878	28	**36.3**	**48**	55	57·5	68	76	**76**	67·5	51·5	41	18·7	**52**
1879	15·3	21	36	49	62·7	68	75	71	60	**59**	36	19·7	47·7
1880	31	28	34	47	66	70	72	72	61	49	**26**	17	47·7
1881	11	17	29	43	**67**	67	74	75	66	52	34	31	48
1882	21	34	35	48	53	67	68	71	69	56	38	21	48·3
1883	7	15	29	49	54	67	72	70	59	47	36	24	**44**
1884	11	19	30	47	61	68	70	68	67	54	36	18	45·7
1885	8	10	28	45	56	68	74	67	62	47	37	24	44
1886	11	21	32	51	61	69	75	74	64	55	34	16	47
1887	10	21	33	50	65	71	76	70	61	46	34	.....	.....
Means.	17·9	23·4	33·1	47·7	60·4	69·1	73·7	71·4	63·5	49·5	35·5	22·9	47·6

Table of monthly precipitation at Oswego, Ill., from January, 1880, to November, 1887, inclusive, from observations of John S. Seely.

Month.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	3·84	1·44	**1.20**	1·68	**0.75**	2·14	2·94	2·98
February	3·84	3·72	3·00	5·05	2·61	1·37	1·68	**4.29**
March	1·64	3·60	3·00	0·63	2·00	**0.14**	3·17	0·80
April	4·92	1·44	5·82	3·68	2·34	2·87	4·04	0·48
May	6·72	1·68	4·80	6·49	2·44	2·48	3·85	2·78
June	3·36	5·88	**6.54**	3·35	3·16	4·92	2·17	**0.29**
July	6·00	2·16	3·60	3·37	**5.95**	3·42	**0.33**	1·21
August	**6.84**	**0.30**	5·28	**0.54**	3·27	**6.22**	4·27	3·48
September	2·88	3·84	1·44	1·26	3·04	4·02	**4.53**	2·70
October	2·04	**7.20**	2·72	**6.60**	5·03	3·71	1·20	2·34
November	1·20	5·04	1·86	4·81	1·62	1·63	0·86	1·78
December	**0.00**	2·93	2·10	1·25	3·95	2·51	1·01	.....
Annual	43·28	39·23	41·36	38·71	36·16	35·43	30·05	.....

Table showing monthly and annual precipitation (in inches and hundredths) at Newark, N. J., from May, 1843, to December, 1887, from observations of Mr. Frederick W. Ricord.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1843	.....	.....	.....	.....	0·85	1·59	2·28	**22.48**	3·61	5·90	3·92	4·14	.....
1844	4·98	1·64	4·78	**0.39**	0·85	2·56	5·82	2·68	2·97	5·51	2·04	3·87	37·49
1845	3·37	4·21	3·76	1·27	2·15	3·40	2·17	4·80	2·45	2·25	2·87	3·73	36·43
1846	5·12	4·16	3·41	3·26	**8.74**	2·17	4·73	4·10	0·55	2·81	**8.74**	3·74	51·53
1847	4·65	**6.07**	4·14	0·85	3·15	6·25	3·30	2·89	11·30	3·46	2·84	5·91	54·81
1848	1·82	1·81	2·39	1·33	5·98	6·00	2·06	0·95	2·19	4·76	2·92	4·52	36·73
1849	**0.64**	2·69	4·85	0·92	4·23	1·09	2·36	8·08	1·60	6·93	2·18	4·47	39·84
1850	5·08	3·05	4·17	3·03	7·43	3·53	7·42	4·72	4·40	1·72	1·52	5·11	51·18
1851	2·01	4·50	3·97	6·09	3·93	1·10	6·43	1·52	0·62	3·66	4·61	1·93	40·37
1852	2·92	2·20	4·80	5·21	3·67	1·72	2·53	4·16	1·74	2·17	5·84	**7.84**	44·70
1853	3·09	5·22	3·14	3·01	4·67	3·65	3·25	11·22	5·03	5·08	3·67	1·28	52·31
1854	1·79	5·02	**0.98**	4·36	4·17	2·10	3·58	1·12	3·90	2·44	4·31	3·63	36·46
1855	4·03	3·47	1·87	2·47	2·36	4·52	4·47	4·16	2·25	5·26	2·89	6·50	44·25
1856	3·37	1·25	2·00	2·57	4·31	3·12	1·41	5·70	2·66	1·40	2·79	3·48	**3.406**
1857	3·83	1·50	1·99	7·15	6·03	5·34	5·08	4·01	3·81	3·95	**0.87**	5·78	49·34
1858	3·40	2·49	1·01	3·85	4·99	4·65	2·99	4·21	1·41	3·01	4·78	4·26	41·05
1859	6·05	3·80	6·88	5·30	2·55	3·94	4·02	6·26	6·98	2·55	3·78	5·20	**57.31**
1860	2·32	2·71	1·22	2·51	5·00	1·81	2·72	6·23	5·65	2·83	6·71	3·42	43·13
1861	4·46	1·88	4·91	4·92	5·19	2·60	**1.12**	3·97	3·26	2·86	6·42	1·99	43·58
1862	5·41	3·69	3·99	3·21	3·04	6·60	3·02	3·00	2·12	4·26	4·45	1·85	44·64
1863	4·27	4·25	5·25	5·83	4·49	**1.04**	3·95	4·97	1·30	3·44	2·61	4·57	45·97
1864	1·73	**0.82**	3·14	3·67	5·28	1·85	2·67	3·21	4·68	2·67	3·95	4·76	38·43
1865	4·09	4·57	4·89	3·34	5·73	3·48	6·73	3·93	3·21	4·68	3·30	4·38	52·33
1866	1·75	5·07	1·82	2·82	4·40	2·50	1·84	5·34	5·47	3·97	2·09	2·91	39·98
1867	1·61	5·64	4·39	2·57	6·55	**9.74**	3·75	10·61	1·23	4·62	1·94	2·04	54·69
1868	3·27	1·62	2·17	5·25	6·92	5·89	8·53	4·75	8·95	1·25	4·37	3·84	56·81
1869	3·42	5·05	4·67	1·15	4·67	5·84	3·69	1·55	2·54	6·82	3·08	5·43	47·91
1870	4·72	4·26	4·55	7·00	1·99	3·12	6·96	3·09	2·79	4·75	2·46	2·18	47·87
1871	3·03	3·04	4·99	3·68	3·95	7·10	4·14	5·31	1·99	6·02	3·99	2·17	49·41
1872	1·84	1·77	3·88	3·74	3·07	4·27	**8.94**	6·62	3·24	3·11	4·77	3·78	49·03
1873	5·82	3·88	2·76	5·83	3·75	1·71	66·1	7·76	3·55	3·74	4·67	2·47	52·55
1874	5·67	3·16	2·13	**8.71**	2·75	3·58	4·23	2·78	9·05	2·43	2·86	2·81	50·16
1875	3·31	2·40	3·82	3·13	1·59	2·33	5·98	10·21	1·93	2·87	4·30	2·61	44·48
1876	1·20	5·35	**10.90**	3·30	3·04	1·52	3·06	2·45	7·50	1·26	4·04	2·51	45·29
1877	3·06	1·65	6·07	3·12	1·01	4·17	5·98	7·73	1·47	**7.73**	6·91	**0.92**	49·82
1878	**6.52**	4·96	3·63	1·73	4·20	2·44	4·33	8·06	2·53	2·83	4·57	7·47	53·27
1879	2·89	2·53	3·74	4·96	2·17	3·03	5·05	9·12	3·75	**0.32**	1·94	5·33	44·83
1880	2·59	2·83	4·90	3·30	**0.76**	1·18	7·46	4·68	2·48	2·10	2·36	2·68	37·32
1881	5·08	4·64	6·83	1·71	2·91	5·04	1·34	**0.28**	0·87	2·73	3·07	4·53	39·00
1882	5·80	4·73	3·19	2·01	5·69	2·08	3·52	1·31	**17.66**	2·00	1·77	1·94	51·70
1883	3·71	4·92	2·00	4·65	3·35	4·47	2·76	2·46	4·74	5·36	1·43	2·72	42·57
1884	5·16	4·14	5·63	2·66	2·03	4·95	5·28	5·39	**0.25**	3·52	2·92	5·90	47·83
1885	3·33	5·85	1·43	2·03	3·03	1·39	3·11	5·98	5·10	4·47	4·77	3·10	42·59
1886	4·96	4·67	3·95	4·17	7·13	3·19	4·78	1·57	1·63	2·91	4·86	4·25	45·07
1887	3·63	5·43	3·62	3·12	5·80	7·00	7·05	3·23	2·30	2·53	2·08	4·82	50·61
Sums	160·77	158·59	167·71	**155.18**	178·55	160·71	192·50	**228.03**	168·77	160·94	163·26	171·47	2,021·73
Means	3·65	3·60	3·81	**3.58**	3·97	3·57	4·26	**5.07**	3·75	3·58	3·63	3·81	45·95

Table of miscellaneous meteorological data for November, 1887—Signal Service observations.

Stations and districts.	Elevation above sea-level, feet.	Atmospheric pressure, in inches and hundredths. Mean actual barometer.	Departure from normal.	Mean reduced barometer.	Extremes. Highest barometer.	Date.	Lowest barometer.	Date.	Monthly range of barometer.	Temperature of the air, in degrees Fahrenheit. Monthly mean.	Departure from normal.	Extremes. Max.	Date.	Mean max.	Min.	Date.	Mean min.	Monthly range.	Daily ranges. Greatest.	Date.	Least.	Date.	Mean relative humidity, per cent.	Mean temperature of dew-point, degrees Fahrenheit.	Precipitation, in inches.	Departure from normal precipitation, in inches.	Winds. Total movement, miles.	Prevailing direction.	Maximum velocity. Miles p. h.	Direction.	Date.	No. of rainy days.	No. of cloudy days.	No. of fair days.	No. of clear days.
New England.										40.8	−0.4														2.63	−1.63									
Eastport	61	29.91	−.02	29.97	30.81	30	29.13	11	1.68	37.6	+0.6	56.8	28	44.6	4.0	30	30.5	52.8	28.3	8	3.6	3	73.3	29.3	2.32	−2.41	7,984	nw.	51	e.	11	11	10	12	8
Portland	99	29.87	−.05	29.98	30.86	30	29.10	11	1.76	37.7	−2.3	65.7	7	45.0	7.6	30	30.0	58.1	28.0	7	4.6	24	68.3	27.2	4.74	+0.92	6,122	nw.	37	se.	15	11	10	9	11
Manchester	247	29.74	...	30.01	30.89	30	29.26	11	1.63	38.8	...	69.2	4	47.1	7.1	30	27.5	62.1	37.7	4	4.8	25	70.3	26.5	3.02	...	4,444	nw.	28	sw.	4	9	8	9	13
Northfield	871	29.08	...	30.00	30.92	30	29.28	11	1.64	32.4	...	62.3	7	40.5	1.9	30	23.0	60.4	41.2	2	4.1	12	79.8	26.2	3.82	...	6,621	s.	40	nw.	12	12	14	11	5
Boston	125	29.87	−.05	30.00	30.85	30	29.25	11	1.60	41.6	+0.6	69.4	7	50.8	12.0	30	33.8	57.4	29.2	28	5.0	25	75.2	33.5	2.22	−2.79	8,492	w.	42	nw.	16	8	8	11	11
Edgartown	...	...	...	...	...	...	...	...	...	43.2	...	61.3	8	50.5	25.7	6	35.8	35.6	22.4	10	6.7	9	...	...	2.59	...	...	sw.	...	...	...	8	...	...	...
Nantucket	14	30.00	...	30.00	30.71	30	29.29	11	1.42	44.7	...	60.0	4	51.0	27.7	30	37.6	32.3	22.0	7	5.4	2	76.7	37.4	2.54	...	8,704	nw.	46	ne.	1	11	8	15	7
Wood's Holl	22	30.00	...	30.01	30.77	30	29.33	11	1.44	43.5	...	60.6	28	50.3	19.9	30	37.3	40.7	21.8	28	6.1	18	97.1	42.7	2.84	...	10,574	w.	...	...	...	8	4	11	8
Vineyard Haven	...	...	...	...	...	...	...	...	...	46.2	...	66.9	27	55.5	19.0	30	36.8	47.9	31.1	30	6.6	27	...	...	2.54	...	...	nw.	...	...	...	7	...	...	...
Block Island	27	29.99	−.06	30.01	30.78	30	29.32	11	1.46	45.3	+0.3	60.0	27	50.4	19.9	30	38.4	40.1	24.2	28	5.8	24	78.1	38.4	1.68	−2.86	14,054	nw.	60	ne.	1	7	5	12	13
Narragansett Pier	...	...	...	...	...	...	...	...	...	43.0	...	65.0	8	52.0	16.0	30	34.0	49.0	...	...	...	...	...	...	2.47	−1.10	...	nw.	...	...	...	7	...	...	...
New Haven	107	29.92	−.05	30.04	30.84	30	29.35	19	1.49	40.4	−0.6	62.7	3	49.4	18.0	30	31.5	32.7	29.3	28	6.3	24	70.4	30.7	2.85	−1.10	5,941	sw.	36	ne.	1	8	5	12	13
New London	47	29.96	−.08	30.00	30.79	30	29.32	11	1.47	42.3	−0.7	63.0	28	51.2	16.8	30	33.8	46.2	30.5	28	5.7	16	73.7	33.7	2.19	−2.06	5,325	nw.	32	se.	10	7	8	15	7
Mid. Atlantic States.										42.8	−0.8														2.22	−1.13									
Albany	83	29.95	−.05	30.04	30.95	30	29.38	11	1.57	38.1	−2.9	64.6	27	46.0	11.3	30	30.0	53.3	36.2	28	3.7	12	70.3	28.7	4.36	+1.47	5,005	s.	30	n.	28	11	12	12	6
New York City	185	29.85	−.08	30.04	30.77	30	29.40	19	1.37	43.7	−0.3	67.4	26	53.9	22.7	30	37.2	44.7	28.6	28	7.3	11	61.4	30.3	2.04	−1.48	7,091	w.	48	w.	16	7	7	14	9
Philadelphia	117	29.90	−.04	30.07	30.82	30	29.46	19	1.36	45.3	+0.3	69.6	27	53.2	25.0	30	38.8	44.6	28.4	28	5.2	15	62.4	32.0	1.38	−1.87	7,078	w.	44	n.	1	7	8	12	10
Atlantic City	13	30.07	−.04	30.07	30.74	30	29.46	19	1.28	44.0	−1.0	63.5	8	50.8	22.8	21	37.4	40.7	22.0	3	4.6	25	90.0	41.2	2.58	−1.12	3,759	nw.	54	n.	1	8	6	15	9
New Brunswick	...	...	...	...	...	...	...	...	...	41.0	...	67.6	27	49.9	20.9	30	32.5	46.7	33.8	4	8.1	15	80.7	34.9	2.35	...	...	...	...	...	...	7	6	14	10
Baltimore	45	30.05	−.05	30.08	30.83	30	29.47	19	1.36	45.1	−0.9	69.1	4	53.3	25.1	21	37.9	44.0	26.7	28	3.2	24	59.8	30.6	2.02	−1.15	3,833	nw.	28	nw.	11	8	3	13	14
Washington City	106	29.99	−.04	30.09	30.80	30	29.46	19	1.34	44.9	−0.1	70.0	26	53.8	22.7	29	36.8	47.3	33.3	3	4.8	19	60.1	30.4	1.83	−1.08	3,995	nw.	30	nw.	12	7	3	14	13
Cape Henry	16	...	...	...	...	...	...	...	...	49.9	...	76.0	28	57.5	32.0	22	42.4	44.0	36.0	28	5.0	30	...	...	3.08	−0.94	...	w.	...	...	...	5	...	...	...
Lynchburg	652	29.41	−.03	30.10	30.74	30	29.48	19	1.26	46.3	+0.3	75.3	4	58.7	22.4	30	36.3	52.9	40.9	3	9.7	10	66.8	34.0	1.01	−2.37	2,280	sw.	24	nw.	11	6	5	11	14
Norfolk	30	30.10	−.01	30.11	30.64	30	29.67	20	1.06	49.1	−1.9	73.7	26	58.6	29.7	29	40.2	44.0	32.7	3	8.1	1	77.9	41.9	1.69	−1.67	5,296	n.	38	n.	1	8	2	14	14
S. Atlantic States.										54.7	−1.4														1.21	−2.34									
Charlotte	808	29.26	−.03	30.10	30.60	30	29.48	19	1.12	50.1	+0.1	73.9	26	61.3	21.5	21	39.8	52.4	34.2	16	7.9	18	65.1	37.7	0.51	−3.42	3,338	sw.	18	ne.	5	3	4	10	16
Hatteras	12	30.12	.00	30.12	30.53	30	29.61	19	0.92	54.3	−1.8	72.8	26	62.4	38.6	22	47.7	34.2	25.3	28	7.8	9	77.8	47.0	2.87	−2.84	10,570	n.	47	n.	29	8	8	7	15
Kitty Hawk*	9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Raleigh	375	29.73	...	30.11	30.66	30	29.54	19	1.12	46.2	...	71.0	27	56.2	24.9	21	38.2	46.1	30.9	3	7.0	19	75.7	38.2	1.00	...	3,582	sw.	24	sw.	30	8	4	12	14
Southport	34	...	...	...	...	...	...	...	...	52.5	...	70.2	27	60.9	25.0	21	44.1	45.2	29.0	29	10.9	17	...	...	3.68	+0.74	...	nw.	...	...	...	8	...	...	...
Wilmington	52	30.06	−.05	30.09	30.55	30	29.62	19	0.93	51.9	−3.1	73.8	27	62.7	26.0	21	40.8	47.8	32.5	24	13.2	29	74.3	43.5	1.04	−1.55	3,879	n.	23	w.	20	6	2	9	19
Charleston	52	30.09	−.01	30.11	30.51	30	29.63	19	0.88	56.2	−1.8	77.0	28	64.6	28.4	21	47.9	48.6	23.9	20	4.9	18	75.4	47.8	0.64	−2.44	5,142	ne.	25	ne.	9	9	3	7	20
Columbia	...	...	...	...	...	...	...	...	...	53.2	...	76.7	27	63.5	23.3	21	42.0	53.4	33.4	16	10.2	10	68.9	42.0	0.55	...	...	...	...	...	...	4	3	11	16
Augusta	183	29.97	−.02	30.13	30.56	30	29.67	19	0.89	53.4	−0.6	78.4	27	66.2	23.5	21	41.3	54.9	37.3	16	13.3	28	68.7	41.6	0.77	−3.00	2,148	ne.	30	ne.	29	3	4	11	15
Savannah	87	30.05	−.02	30.11	30.49	30	29.72	19	0.77	56.4	−1.6	78.0	27	66.5	25.6	21	46.7	52.4	27.1	23	6.0	8	73.3	46.9	0.29	−2.00	4,192	e.	23	nw.	15	6	5	11	14
Jacksonville	43	30.08	−.02	30.09	30.39	30	29.75	19	0.64	60.9	−1.1	78.2	27	70.4	26.4	21	51.3	51.8	31.7	22	5.3	8	79.0	53.7	0.10	−2.72	4,997	ne.	24	n.	29	7	6	14	10
Florida Peninsula.										67.7	−1.3														1.20	−1.10									
Cedar Keys	22	30.08	−.03	30.06	30.32	30	29.80	20	0.52	62.4	−0.6	77.1	27	70.3	26.8	21	54.3	50.3	31.4	24	5.7	19	75.1	53.8	1.08	−1.28	5,816	ne.	27	ne.	30	5	1	10	19
Key West	20	30.04	−.01	30.01	30.15	22	29.83	20	0.32	73.0	−2.0	82.2	10	76.3	57.2	21	69.3	25.0	16.9	21	3.1	12	77.6	65.4	1.33	−0.92	8,676	ne.	36	nw.	21	2	6	15	9
Titusville	12	30.09	...	30.06	30.27	23	29.75	25	0.52	65.4	...	81.9	10	73.0	32.5	21	57.5	49.4	26.2	18	4.2	7	75.3	56.8	0.88	...	5,945	nw.	38	n.	29	11	2	19	9
Eastern Gulf States.										57.6	+1.6														0.69	−4.14									
Atlanta	1,129	28.96	−.02	30.13	30.55	30	29.65	19	0.90	52.5	+1.5	72.5	16	62.3	16.4	21	41.9	56.1	32.2	20	4.8	7	59.9	37.3	0.30	−4.37	6,553	se.	30	w.	19	4	7	9	14
Pensacola	30	30.09	−.03	30.08	30.39	30	29.81	19	0.58	60.2	+1.2	76.2	15	68.4	28.3	21	52.4	47.9	28.0	22	6.0	9	74.7	51.6	0.65	−4.46	4,322	e.	20	n.	20	5	7	10	13
Mobile	35	30.10	−.02	30.10	30.42	30	29.84	19	0.58	58.6	+1.6	79.8	15	68.6	25.2	21	48.5	54.6	28.3	15	7.2	7	74.8	49.6	0.44	−4.14	4,739	n.	36	n.	27	6	9	9	12
Montgomery	217	29.91	−.02	30.12	30.50	30	29.78	19	0.72	56.2	+2.2	79.0	26	67.4	21.4	21	44.3	57.6	35.9	16	6.4	8	64.8	42.7	0.79	−2.98	3,203	ne.	24	nw.	20	4	10	5	15
Vicksburg	209	29.91	−.02	30.12	30.52	28	29.84	19	0.68	57.1	+2.1	81.1	15	68.2	27.1	21	46.4	54.0	36.0	27	8.7	18	66.8	44.7	1.43	−4.11	3,695	s.	27	n.	27	6	10	7	13
Oxford	...	...	...	...	...	...	...	...	...	52.8	...	74.2	16	62.1	17.4	28	41.7	56.8	38.4	27	10.2	23	68.0	41.8	1.28	...	...	...	...	...	...	3	8	5	17
New Orleans	52	30.07	−.01	30.09	30.38	29	29.86	19	0.52	61.1	+1.1	80.1	17	70.1	34.0	21	53.7	46.1	27.8	22	3.9	9	73.5	51.6	0.52	−4.76	4,873	n.	24	n.	27	5	6	7	17
Western Gulf States.										57.4	+0.7														2.76	−1.22									
Shreveport	227	29.89	−.03	30.10	30.54	28	29.84	16	0.70	55.9	+1.9	79.8	15	68.5	26.3	28	44.8	53.5	36.0	27	12.6	18	72.7	46.0	5.45	+0.66	3,166	s.	23	nw.	27	7	7	9	14
Fort Smith	470	29.63	+.01	30.12	30.62	28	29.76	16	0.86	50.1	+0.1	79.1	1	63.2	17.0	28	37.1	62.1	41.5	11	10.2	24	60.6	35.0	2.23	−0.95	3,216	ne.	28	n.	19	8	5	5	20
Little Rock	299	29.81	−.01	30.11	30.60	29	29.74	16	0.86	51.8	+1.8	77.0	3	63.5	0.4	20	39.5	76.6	39.6	27	9.0	25	59.8	36.0	4.50	−0.23	3,94[illegible]	sw.	27	nw.	19	6	3	5	21
Corpus Christi	18	30.10	.00	30.08	30.47	28	29.87	26	0.60	63.8	−3.2	76.8	16	70.4	32.6	28	56.0	44.2	32.8	27	6.6	23	81.9	57.8	0.66	...	7,008	e.	60	ne.	20	4	10	8	12
Galveston	40	30.10	+.01	30.10	30.42	29	29.94	17	0.48	64.0	+2.0	76.4	17	70.1	37.2	28	57.8	39.2	30.3	27	5.4	6	71.1	53.7	0.05	−4.81	3,786	s.	14	n.	28	2	4	13	13
Palestine	533	29.59	.00	30.12	30.57	28	29.90	26	0.67	56.5	−0.5	79.8	15	68.1	20.3	28	45.6	59.5	43.1	27	10.7	24	66.9	44.3	1.86	−2.85	5,490	s.	48	s.	16	4	8	6	16
San Antonio	781	29.30	−.01	30.09	30.49	28	29.84	26	0.65	59.5	+2.5	79.7	7	70.2	27.6	28	49.4	52.1	35.0	27	9.5	23	67.9	47.5	2.44	+0.86	5,028	ne.	36	n.	27	7	12	7	11
Rio Grande Valley.										65.7	+1.2														1.87	+0.38									
Brownsville	59	30.04	.00	30.05	30.42	28	29.83	26	0.59	66.3	+1.3	80.2	8	73.7	39.7	28	59.8	40.5	25.5	27	5.5	10	86.3	61.7	1.70	−0.43	4,646	s.	27	s.	22	4	7	15	8
Rio Grande City	230	29.91	.00	30.11	30.52	28	29.83	26	0.69	65.1	+1.1	82.4	22	74.2	41.2	28	57.4	41.2	31.8	1	5.2	12	78.0	57.1	2.04	+1.19	3,424	s.	24	n.	27	6	9	14	9
Ohio Val. & Tenn.										46.0	+1.0														2.36	−1.51									
Chattanooga	783	29.34	.00	30.15	30.58	30	29.60	19	0.98	50.1	+1.1	76.1	4	61.5	16.3	21	39.5	59.8	38.3	3	8.2	7	61.8	35.5	1.08	−3.85	3,838	s.	41	nw.	19	4	5	9	16
Knoxville	980	29.13	.00	30.16	30.61	30	29.56	19	1.05	47.5	+1.5	73.0	26	59.2	14.7	21	36.2	58.3	36.0	3	7.4	10	59.2	32.2	0.93	−3.56	3,560	ne.	36	w.	19	3	4	12	14
Memphis	321	29.78	−.03	30.10	30.61	28	29.73	19	0.88	51.5	+2.5	76.3	16	63.1	17.8	28	41.0	58.5	45.1	27	9.2	25	62.2	37.0	4.00	−0.65	4,536	se.	36	w.	19	6	8	5	17
Nashville	549	29.55	−.01	30.12	30.63	28	29.69	19	0.94	48.4	+0.4	74.8	16	59.8	10.5	28	36.3	64.3	46.0	27	8.4	23	64.2	35.5	2.29	−1.65	4,079	se.	29	nw.	19	7	7	6	17
Lexington	...	29.00	...	...	...	...	...	...	...	44.0	...	71.7	26	54.6	6.1	28	33.1	65.6	40.8	27	10.3	23	60.1	29.2	3.02	...	5,005	s.	30	sw.	19	8	4	11	15
Louisville	551	29.54	−.01	30.12	30.72	30	29.52	19	1.20	46.1	+0.1	75.1	3	56.4	8.4	28	34.4	66.7	47.6	27	7.6	23	57.1	30.0	2.51	−1.38	5,355	s.	36	w.	19	8	7	10	13
Indianapolis	766	29.27	−.02	30.09	30.76	30	29.46	19	1.30	40.5	−0.5	73.5	3	50.7	3.8	28	30.1	69.7	47.0	27	5.3	23	60.8	26.1	3.71	+0.05	4,458	s.	32	nw.	27	8	5	12	13
Terre Haute	...	...	...	...	...	...	...	...	...	42.0	...	74.3	3	53.7	5.0	28	30.2	69.3	36.6	2	7.1	23	...	...	5.76	...	...	s.	...	...	...	7	...	...	...
Cincinnati	628	29.44	−.02	30.10	30.76	29	29.43	19	1.33	43.4	−0.6	74.2	3	53.8	8.2	28	33.2	66.0	43.9	27	8.0	15	61.3	29.1	2.83	−0.42	5,117	se.	36	sw.	19	10	9	10	11
Columbus	805	29.23	−.01	30.10	30.83	30	29.41	19	1.42	41.4	+1.4	73.8	3	51.2	3.0	29	32.2	70.8	37.4	2	4.0	23	67.2	30.2	2.45	−0.95	5,373	s.	32	sw.	19	10	11	8	11
Pittsburg	766	29.17	−.03	30.06	30.83	30	29.34	19	1.49	44.7	+2.7	74.2	27	52.3	14.2	29	35.9	60.0	32.2	27	4.1	25	68.1	33.8	1.37	−1.22	5,650	nw.	30	nw.	19	7	15	5	10
Lower lake region.										38.7	−0.6														2.55	−0.66									
Buffalo	690	29.28	−.01	30.03	30.96	30	29.38	19	1.58	38.0	−1.0	64.5	27	45.1	14.6	29	31.9	49.9	29.0	27	5.0	15	70.3	28.5	2.53	−1.05	10,039	sw.	45	sw.	18	15	15	8	7
Oswego	335	29.64	−.04	30.01	31.00	30	29.36	19	1.64	37.5	−1.5	70.2	27	44.7	9.2	30	30.9	61.0	35.5	2	2.3	16	72.5	28.3	2.38	−0.87	9,918	nw.	36	w.	17	15	18	6	6
Rochester	621	29.32	−.06	30.00	30.93	30	29.30	19	1.63	37.6	−0.4	71.1	27	45.3	15.5	30	30.2	55.6	33.3	2	6.0	19	71.7	28.4	0.80	−2.06	9,439	sw.	36	sw.	18	11	14	11	5
Erie	681	29.30	−.02	30.04	30.92	30	29.33	19	1.59	39.8	−0.2	69.9	27	51.4	14.4	30	32.2	55.5	36.9	27	9.0	14	76.6	32.7	4.13	−0.56	8,565	sw.	36	nw.	11	14	10	12	8
Cleveland	690	29.31	−.03	30.06	30.88	30	29.32	19	1.56	40.2	+1.2	67.2	7	48.7	6.3	29	31.4	60.9	34.2	27	4.0	15	69.7	30.0	2.97	+0.21	8,420	sw.	34	nw.	11	10	16	9	5
Sandusky	639	29.38	−.01	30.07	30.84	30	29.34	19	1.50	39.8	−0.2	68.9	7	49.4	4.2	29	30.9	64.7	37.6	27	5.2	20	71.4	30.2	2.25	−0.99	9,574	sw.	48	nw.	11	10	7	13	10
Toledo	651	29.35	−.02	30.05	30.86	30	29.29	19	1.57	38.6	−1.4	66.0	7	47.7	10.8	29	30.1	55.2	38.5	27	7.6	25	69.3	27.8	2.64	−0.23	6,410	sw.	32	sw.	27	9	5	13	12
Detroit	661	29.32	−.02	30.04	30.92	30	29.26	19	1.66	38.4	−1.6	63.7	7	45.4	16.2	29	31.1	47.5	30.6	27	3.0	25	72.8	29.5	2.72	+0.30	7,844	sw.	32	sw.	27	10	10	14	6
Upper lake region.										34.1	+0.3														1.84	−0.74									
Alpena	609	29.33	.00	30.01	30.98	30	29.28	19	1.70	33.5	+0.5	64.6	7	39.5	6.7	29	27.7	57.3	31.6	6	3.8	9	79.3	27.2	2.71	−0.27	7,653	nw.	36	w.	17	13	18	9	3
Escanaba	613	29.34	+.02	30.02	30.96	30	29.19	19	1.77	31.1	+1.1	64.6	7	37.1	−7.4	29	24.6	72.0	29.5	27	4.6	14	74.1	23.1	0.98	−1.67	6,501	n.	36	n.	19	8	13	12	5
Grand Haven	620	29.34	−.02	30.02	30.83	30	29.15	19	1.68	36.2	−1.8	58.8	3	41.8	12.7	28	30.3	46.1	27.7	27	3.3	25	76.2	28.7	1.72	−1.42	9,944	nw.	42	nw.	19	10	14	8	8
Lansing	64	29.08	...	30.03	30.80	30	29.23	19	1.63	38.5	...	63.8	7	47.0	16.1	29	31.7	47.7	34.0	27	4.8	25	83.4	33.6	1.96	...	6,313	sw.	32	sw.	18	9	13	10	7
Mackinaw City	605	29.33	+.02	30.01	31.00	30	29.25	19	1.75	33.2	+1.2	62.2	7	38.3	6.0	30	27.2	56.2	27.2	7	3.9	15	76.3	25.8	1.09	−1.51	10,393	nw.	36	nw.	17	14	16	7	7
Marquette	669	29.27	+.02	30.03	30.94	30	29.21	19	1.73	31.2	+0.2	64.5	6	37.2	5.3	28	23.9	69.8	30.9	27	4.5	10	74.4	23.5	3.03	+0.50	7,103	nw.	35	nw.	19	17	15	10	5
Port Huron	633	29.34	−.01	30.04	30.91	30	29.31	19	1.60	36.9	+0.9	60.2	7	43.6	12.1	29	29.2	48.1	31.3	27	2.6	23	77.1	29.6	1.79	−0.89	9,216	w.	36	w.	27	14	13	12	5
Chicago	661	29.28	−.02	30.05	30.74	30	29.24	19	1.50	38.0	−1.0	67.0	6	45.8	−1.0	29	26.4	68.0	42.3	27	5.0	20	70.9	28.4	2.41	−0.36	9,192	sw.	36	sw.	18	7	11	8	11
Green Bay	616	29.36	...	30.05	30.91	30	29.19	19	1.72	32.3	...	63.9	7	39.6	−12.3	28	23.8	76.2	36.1	27	4.4	24	74.2	24.5	1.57	...	6,440	sw.	36	n.	19	6	11	14	5
Milwaukee	697	29.27	−.01	30.03	30.80	30	29.19	19	1.61	35.9	−0.1	68.7	6	43.8	−3.6	28	28.8	72.3	34.0	27	5.9	10	75.9	28.1	0.85	−1.21	8,938	sw.	48	w.	17	7	9	12	9
Duluth	672	29.28	.00	30.04	30.87	30	29.20	18	1.61	30.5	+2.5	64.7	1	37.8	−15.1	28	22.2	79.8	28.6	1	5.3	10	74.8	22.8	1.99	+0.20	5,108	sw.	39	nw.	19	11	10	10	9
Extreme northwest.										25.0	+1.6														0.26	−0.42									
Moorhead	923	29.03	+.01	30.08	30.79	29	29.40	18	1.39	25.9	+1.9	71.5	1	36.2	−22.0	28	15.4	93.5	40.0	1	6.9	14	73.9	17.6	0.57	−0.68	6,747	s.	42	n.	18	9	6	14	10
Saint Vincent	804	29.14	−.03	30.08	30.91	29	29.40	20	1.51	19.9	−0.1	69.1	6	32.5	−30.2	29	5.4	99.3	42.4	30	12.1	14	78.7	13.7	0.22	−0.34	6,123	s.	37	nw.	16	4	4	16	10
Bismarck	1,694	28.24	+.03	30.10	30.66	20	29.53	20	1.13	28.4	+2.4	72.9	1	41.9	−25.0	27	14.4	99.8	43.7	10	12.7	21	71.4	18.6	0.11	−0.64	6,652	nw.	59	nw.	18	7	3	13	14
Fort Buford	1,930	27.98	.00	30.03	30.66	26	29.43	20	1.23	26.7	+0.7	68.5	10	38.9	−29.0	28	14.3	97.5	39.1	11	12.3	3	70.7	17.0	0.10	−0.31	6,199	w.	60	nw.	18	3	8	14	8
Fort Totten	1,500	28.39	...	30.07	30.79	29	29.42	18	1.37	24.2	+3.2	70.0	6	35.7	−23.2	27	13.7	93.2	35.7	10	10.0	19	75.7	16.6	0.40	−0.20	9,023	w.	45	nw.	18	5	8	10	12
Fort Yates	...	...	...	...	...	...	...	...	...	31.9	...	76.0	1	46.7	−21.4	27	17.2	97.4	47.0	5	9.2	24	...	...	0.15	−0.33	...	nw.	...	...	...	7	...	...	...

Table of miscellaneous meteorological data for November, 1887—Signal Service observations—Continued.

Stations and districts.	Elevation above sea-level, feet.	Atmospheric pressure: Mean actual barometer.	Departure from normal.	Mean reduced barometer.	Extremes: Highest barometer.	Date.	Lowest barometer.	Date.	Monthly range of barometer.	Temperature of the air: Monthly mean.	Departure from normal.	Extremes: Max.	Date.	Mean max.	Min.	Date.	Mean min.	Monthly range.	Daily ranges: Greatest.	Date.	Least.	Date.	Mean relative humidity, per cent.	Mean temperature of dew-point, degrees Fahrenheit.	Precipitation, in inches.	Departure from normal precipitation, in inches.	Winds: Total movement, miles.	Prevailing direction.	Maximum velocity: Miles p. h.	Direction.	Date.	No. of rainy days.	No. of cloudy days.	No. of fair days.	No. of clear days.
Upper Miss. Valley.										38.7	+0.2														1.65	-0.78									
Saint Paul	831	29.13	+.01	30.05	30.75	30	29.33	18	1.42	31.2	+1.2	70.2	1	40.2	-20.5	28	22.6	90.7	35.2	1	5.2	24	74.9	23.3	0.65	-0.72	4,222	nw.	38	w.	19	8	10	12	8
La Crosse	725	29.27	+.04	30.09	30.82	30	29.40	19	1.42	33.1	-0.9	67.5	6	41.6	-18.8	28	24.6	86.3	34.5	27	6.2	26	71.2	23.4	0.81	-1.04	5,755	nw.	45	nw.	19	6	11	11	8
Davenport	615	...	...	...	...	..	...	..	...	...	...	...	..	...	...	..	...	...	...	..	...	..	...	...	...	...	...	...	...	...	..	..	..	..	..
Des Moines	865	29.15	.00	30.08	30.61	28	29.62	21	0.99	37.3	+1.3	73.4	6	47.8	-9.1	28	25.7	82.5	37.2	3	6.5	9	67.4	26.2	0.52	-1.77	5,615	nw.	40	nw.	19	5	7	8	15
Dubuque	665	29.35	+.01	30.08	30.75	30	29.35	19	1.40	35.0	-1.0	71.5	6	44.8	-12.0	28	25.9	83.5	35.8	6	5.6	25	74.3	26.8	0.74	-1.44	3,450	w.	25	nw.	19	5	9	7	14
Keokuk	618	29.41	-.01	30.07	30.62	28	29.61	19	1.01	40.5	+1.5	75.8	2	51.9	7.1	28	31.9	68.7	35.2	19	4.0	24	62.6	27.1	1.18	-0.78	6,667	sw.	36	w.	19	5	7	7	16
Cairo	359	29.76	-.01	30.12	30.66	28	29.69	19	0.97	46.6	-0.4	75.1	3	57.4	10.0	28	35.6	65.4	47.2	27	5.9	24	58.6	30.9	3.33	-0.72	5,423	n.	36	n.	16	7	9	6	15
Springfield	644	29.41	-.01	30.10	30.67	30	29.49	19	1.18	41.2	-0.8	77.0	3	52.6	3.9	28	30.4	73.1	44.1	27	5.8	24	62.9	28.2	1.36	-1.67	6,445	s.	42	nw.	19	6	4	10	16
Saint Louis	571	29.48	-.03	30.09	30.66	28	29.53	19	1.13	44.8	+0.8	79.3	3	56.0	10.5	28	34.6	68.8	45.8	27	5.0	24	54.3	26.6	4.61	+1.94	8,540	s.	54	sw.	19	6	4	9	17
Forest Park	...	29.56	...	...	...	..	...	..	...	42.0	...	79.3	3	54.7	5.3	19	28.1	74.0	45.7	2	5.7	25	68.0	30.7	4.10	...	4,249	s.	36	nw.	19	6	4	9	17
Missouri Valley.										37.1	+2.1														0.66	-0.36									
Lamar	1,028	29.04	...	30.14	30.65	27	29.73	16	0.92	45.0	0.0	77.9	15	58.2	4.9	27	32.5	73.0	39.9	15	8.0	24	67.6	33.0	1.50	+0.42	7,206	s.	48	nw.	19	3	6	7	17
Springfield	1,356	28.67	...	30.11	30.62	27	29.74	16	0.88	45.8	...	78.9	15	59.0	7.8	28	34.8	71.1	39.3	15	6.7	24	64.2	32.9	3.27	...	7,391	se.	48	nw.	19	5	6	6	18
Leavenworth	842	29.22	+.01	30.11	30.62	27	29.69	21	0.93	42.8	+1.8	80.3	3	54.4	-4.3	27	31.3	84.6	40.8	15	2.7	25	65.4	30.7	1.14	-1.22	5,016	s.	36	nw.	19	6	5	11	14
Topeka	...	...	...	...	...	..	...	..	...	42.2	...	82.1	2	55.8	-5.2	27	28.6	87.3	45.8	15	6.2	25	71.7	32.5	1.21	...	...	...	...	...	..	6	6	11	13
Omaha	1,113	28.92	+.01	30.12	30.58	28	29.60	21	0.98	39.6	+3.6	79.6	1	52.8	-13.6	27	27.9	93.2	38.1	1	10.8	25	57.8	24.0	0.89	-0.44	5,853	n.	42	nw.	19	4	8	8	14
Crete	...	...	...	...	...	..	...	..	...	36.6	...	80.5	1	51.8	-16.9	27	25.5	97.4	45.5	26	6.6	8	68.9	27.3	1.42	...	...	...	...	...	..	4	6	8	16
Valentine	2,604	27.32	...	30.09	30.64	26	29.39	21	1.25	33.9	+1.9	75.2	6	50.2	-31.5	27	19.0	*	54.3	20	10.0	30	57.9	16.5	0.13	-0.31	7,648	nw.	64	nw.	18	1	5	11	14
Fort Sully	1,600	28.34	...	30.09	30.62	26	29.50	21	1.12	33.0	+4.0	77.1	1	46.7	-26.6	27	19.4	†	44.8	2	8.6	24	61.1	18.2	0.13	-0.45	5,938	w.	52	w.	18	2	3	11	16
Huron	1,307	28.65	+.01	30.09	30.60	29	29.53	20	1.07	30.4	+0.4	76.5	1	45.4	-27.5	28	17.4	‡	44.7	1	8.6	24	58.4	15.8	0.25	-0.41	7,106	nw.	54	nw.	18	4	3	12	15
Yankton	1,234	28.72	-.03	30.06	30.55	28	29.48	21	1.07	35.3	+3.3	78.2	6	48.6	-18.1	27	24.1	96.3	42.6	1	11.3	8	66.8	24.3	0.57	-0.10	5,767	nw.	44	w.	19	3	2	12	16
Northern slope.										34.6	+2.5														0.42	-0.28									
Fort Assinaboine	2,720	27.17	-.02	30.08	30.74	26	29.58	6	1.16	28.9	-0.1	70.6	5	40.1	-29.8	27	17.6	‖	36.1	4	8.9	30	57.5	13.8	0.29	-0.63	8,803	w.	58	w.	20	2	8	17	5
Fort Custer	3,040	26.88	+.01	30.10	30.64	26	29.49	21	1.15	34.1	+2.1	71.7	10	47.1	-20.3	27	20.6	92.0	39.5	11	14.5	29	58.9	17.5	0.05	-0.40	4,609	se.	60	nw.	12	3	6	14	10
Fort Maginnis	4,340	25.55	+.02	30.04	30.58	26	29.57	20	1.01	36.2	+2.2	66.8	4	43.4	-13.0	26	24.4	79.8	33.5	21	6.8	16	75.5	25.1	1.39	+0.56	9,781	nw.	69	nw.	18	5	9	15	6
Helena	4,044	25.80	-.02	30.09	30.57	26	29.60	21	0.97	33.9	+2.9	65.5	5	43.6	-11.1	26	25.0	76.6	32.4	5	9.9	16	57.4	19.9	0.22	-0.36	4,443	nw.	34	nw.	15	2	4	14	12
Poplar River	2,030	...	...	...	...	..	...	..	...	...	...	...	..	...	...	..	...	...	...	..	...	..	...	...	...	...	...	...	...	...	..	..	..	..	..
Deadwood	4,600	25.37	+.01	30.10	30.43	17	29.46	21	0.97	35.0	+3.0	64.3	1	45.6	-10.9	26	24.9	53.4	35.2	30	8.9	18	73.1	26.5	0.48	-0.87	2,967	w.	25	nw.	18	6	4	14	12
Cheyenne	6,105	24.01	+.01	30.07	30.60	26	29.46	21	1.14	38.0	+5.0	70.1	2	51.4	-11.5	27	24.4	81.6	45.5	27	10.2	23	38.8	5.9	0.29	-0.02	7,658	nw.	42	s.	21	4	4	11	15
North Platte	2,841	27.12	.00	30.12	30.61	26	29.53	21	1.08	36.2	+2.2	81.2	1	52.3	-25.2	27	21.9	§	48.4	15	8.1	23	71.0	26.3	0.19	-0.24	5,452	nw.	36	nw.	19	4	4	12	14
Middle slope.										41.8	+3.4														0.36	-0.31									
Colorado Springs	...	...	...	...	...	..	...	..	...	38.8	...	71.3	1	54.2	-16.1	27	24.0	87.4	54.8	27	11.3	25	50.1	18.9	0.40	...	...	...	...	...	..	4	4	11	15
Denver	5,294	24.76	.00	30.07	30.60	26	29.45	21	1.15	40.4	+3.4	73.7	15	56.0	-14.2	27	25.8	87.9	54.0	27	9.1	23	52.9	22.0	0.22	-0.55	5,106	s.	36	nw.	18	2	4	9	17
Las Animas	3,899	26.08	+.02	30.07	30.59	27	29.50	21	1.09	39.1	+2.1	79.3	15	57.3	-16.0	27	21.8	95.3	51.9	15	12.1	25	45.6	13.8	0.28	-0.01	3,591	w.	24	n.	26	2	4	7	19
Concordia	1,384	28.62	...	30.10	30.61	27	29.59	21	1.02	41.7	+4.7	81.5	1	54.1	-15.0	27	29.1	96.5	43.5	1	11.5	25	53.4	23.8	1.10	+0.15	5,593	n.	32	n.	22	3	5	8	17
Dodge City	2,517	27.46	+.01	30.13	30.68	27	29.60	21	1.08	42.5	+3.5	79.7	2	57.3	-12.9	27	28.3	92.6	46.7	11	6.4	25	52.6	22.1	0.35	-0.25	6,046	ne.	36	n.	26	2	2	8	20
Fort Reno	...	...	...	...	...	..	...	..	...	48.8	...	83.3	15	63.7	-1.2	27	34.0	82.1	...	..	...	..	...	...	0.16	-0.39	...	s.	...	...	..	5	..	..	..
Fort Supply	...	...	...	...	...	..	...	..	...	47.3	...	83.4	8	65.3	-5.0	27	29.3	36.0	50.0	17	7.3	25	...	...	0.15	-0.77	...	s.	...	...	..	3	..	..	..
Fort Elliott	2.650	27.32	+.02	30.04	30.56	27	29.57	21	0.99	45.1	+3.1	79.3	15	61.2	-5.4	27	31.8	84.7	45.1	21	6.1	24	54.1	26.8	0.23	-0.35	70,52	n.	48	n.	26	2	3	5	22
Southern slope.										51.3	+2.9														0.79	+0.06									
Fort Sill	1,200	28.87	.00	30.12	30.64	21	29.69	21	0.95	48.9	+3.9	76.0	7	62.4	8.1	28	36.7	67.9	38.0	21	9.0	24	59.7	33.4	0.34	-1.43	6,696	n.	38	n.	16	5	5	6	19
Abilene	1,748	28.28	...	30.09	30.58	28	29.77	21	0.81	52.6	+2.6	80.0	15	63.8	13.3	27	41.6	66.7	38.5	26	11.7	24	71.2	42.4	0.87	+0.43	6,782	sw.	42	n.	26	3	6	8	16
Fort Davis	4,928	25.23	-.02	30.05	30.38	27	29.70	20	0.62	52.3	+2.3	75.1	21	63.9	27.1	27	41.7	48.0	35.0	14	6.0	10	53.0	33.2	1.80	+1.40	4,347	sw.	40	sw.	22	4	6	8	18
Fort Stanton	6,150	24.00	...	29.95	30.29	10	29.56	25	0.73	41.6	...	69.0	2	58.4	12.1	28	25.8	56.9	43.9	2	16.4	22	63.0	27.9	0.17	-0.15	4,028	nw.	30	nw.	26	3	1	9	19
Southern plateau.										51.7	+4.3														0.88	+0.33									
El Paso	3,764	26.31	-.01	30.05	30.04	28	29.80	25	0.56	54.2	+4.2	77.2	3	68.9	23.8	28	39.6	53.4	41.4	15	10.6	9	59.0	38.9	0.56	+0.08	1,297	nw.	20	e.	9	3	2	7	21
Lava	...	...	...	...	...	..	...	..	...	47.0	...	70.0	13	64.7	18.0	28	29.3	52.0	...	..	...	..	...	...	0.03	-0.07	...	sw.	...	...	..	2	..	..	..
Santa Fé	7,026	23.31	+.04	30.08	30.45	27	29.72	25	0.73	41.9	+6.9	67.0	2	53.3	14.9	28	30.8	52.1	31.5	3	8.9	25	46.3	19.4	0.66	-0.21	3,228	n.	25	n.	6	6	4	7	19
Fort Apache	5,050	...	...	...	...	..	...	..	...	...	...	...	..	...	...	..	...	...	...	..	...	..	...	...	...	...	...	...	...	...	..	..	..	..	..
Fort Bowie	...	...	...	...	...	..	...	..	...	51.8	...	69.0	3	61.9	29.0	28	41.6	40.0	...	..	...	..	...	...	1.10	+0.36	...	sw.	...	...	..	6	..	..	..
Fort Grant	4,910	25.23	-.03	30.02	30.25	27	29.79	25	0.46	53.6	+3.6	74.7	4	64.7	27.7	28	43.3	47.0	34.0	13	7.2	22	38.6	26.7	0.28	-0.29	3,497	n.	30	se.	10	3	5	11	14
Fort McDowell	...	...	...	...	...	..	...	..	...	58.0	...	85.0	2	74.2	31.0	27	41.8	54.0	...	..	...	..	...	...	1.82	+0.94	...	sw.	...	...	..	5	..	..	..
Fort Thomas	2,710	...	...	...	...	..	...	..	...	49.6	...	84.7	7	65.2	26.8	27	34.1	57.9	53.1	7	10.1	22	...	...	0.52	+0.20	...	se.	...	...	..	5	..	..	..
Fort Verde	...	...	...	...	...	..	...	..	...	49.6	...	89.0	4	70.9	25.0	28	28.2	64.0	...	..	...	..	...	...	1.37	+0.68	...	w.	...	...	..	5	..	..	..
Prescott	5,389	24.77	+.01	30.07	30.37	27	29.66	25	0.71	44.7	+2.7	73.0	1	60.9	19.5	27	31.1	53.5	41.9	14	3.8	23	66.5	32.2	1.57	+0.79	2,861	sw.	48	sw.	25	5	2	8	20
San Carlos	...	...	...	...	...	..	...	..	...	49.7	...	82.1	6	70.9	18.0	27	28.5	64.1	59.0	14	16.0	22	...	...	0.22	-0.34	...	nw.	...	...	..	2	..	..	..
Willcox	...	...	...	...	...	..	...	..	...	...	...	...	..	...	...	..	...	...	...	..	...	..	...	...	...	...	...	...	...	...	..	..	..	..	..
Yuma	141	29.84	-.04	29.96	30.25	27	29.74	22	0.51	64.0	+4.0	90.6	1	78.5	37.8	30	50.0	52.8	39.4	2	7.7	22	57.2	46.3	2.43	+2.25	3,286	ne.	21	n.	27	3	2	5	23
Keeler	3,622	26.37	...	30.02	30.34	27	29.66	24	0.68	52.2	...	70.0	4	60.9	28.1	30	41.5	41.9	27.4	26	12.1	5	42.7	28.7	0.01	-0.35	3,113	e.	43	nw.	25	1	1	11	18
Middle plateau.										40.6	+5.6														0.40	-0.92									
Fort Bidwell	4,615	25.44	...	30.15	30.52	19	29.79	28	0.73	39.6	...	67.4	1	52.3	3.6	26	24.7	63.8	41.0	19	13.4	30	75.3	31.6	0.38	-2.79	3,199	w.	32	w.	24	5	5	12	13
Winnemucca	4,358	25.72	+.01	30.18	30.57	19	29.75	22	0.82	37.4	+3.4	71.3	1	55.0	-3.4	26	19.4	74.7	50.6	1	10.3	22	56.6	20.4	0.03	-0.91	4,891	e.	30	n.	24	1	0	11	19
Frisco	6,406	23.75	...	29.99	30.30	27	29.52	25	0.84	42.9	...	64.5	1	50.9	7.2	26	33.3	57.3	29.5	27	10.7	30	42.3	19.0	0.39	-0.71	6,089	sw.	35	sw.	22	3	2	10	18
Salt Lake City	4,348	25.70	-.04	30.12	30.53	27	29.60	24	0.93	43.7	+7.7	67.0	11	54.2	11.3	27	31.3	55.7	32.5	4	13.0	26	46.8	23.2	0.25	-1.37	2,863	e.	23	n.	25	1	3	12	15
Montrose	5,780	24.36	...	30.10	30.57	27	29.56	25	1.01	37.2	...	65.0	1	51.7	7.7	28	25.7	57.3	36.8	1	5.6	23	57.8	22.9	1.08	+0.56	3,149	se.	24	sw.	25	6	6	4	20
Fort Bridger	6,643	23.54	...	30.11	30.41	27	29.62	21	0.79	34.5	...	62.0	2	48.3	-1.7	26	21.0	63.7	39.5	2	17.3	25	52.6	17.8	0.27	-0.32	5,124	e.	40	e.	21	3	4	15	11
Northern plateau.										38.9	+1.6														1.14	-0.70									
Boisé City	2,750	27.30	+.02	30.20	30.52	18	29.87	22	0.65	39.3	+2.3	71.7	5	54.7	5.6	26	25.3	66.1	46.2	14	18.8	27	60.4	24.6	0.04	-0.80	1,474	nw.	26	nw.	25	2	4	14	12
Ashland	...	...	...	...	...	..	...	..	...	43.6	...	78.0	1	54.9	16.0	26	32.2	62.0	36.0	11	13.0	16	...	...	0.94	-2.12	...	w.	...	...	..	8	..	..	..
Fort Klamath	...	...	...	...	...	..	...	..	...	33.7	...	64.0	3	47.0	2.0	26	20.3	62.0	43.0	3	9.0	12	...	...	1.66	-1.09	...	s.	...	...	..	8	..	..	..
Lakeview	...	...	...	...	...	..	...	..	...	38.4	...	74.0	3	54.1	12.0	26	22.7	62.0	39.5	3	8.5	11	...	...	0.32	-1.58	...	s.	...	...	..	6	..	..	..
Linkville	...	...	...	...	...	..	...	..	...	38.0	...	66.2	1	49.2	6.6	26	26.7	59.6	32.6	1	8.1	28	...	...	0.72	-0.80	...	nw.	...	...	..	5	..	..	..
Spokane Falls	1,910	28.06	+.01	30.14	30.56	17	29.72	5	0.84	36.7	+0.7	58.8	5	44.6	9.8	26	27.4	49.0	27.6	22	6.2	11	81.0	30.9	1.22	-0.81	2,614	ne.	24	sw.	13	10	15	11	4
Walla Walla	1,018	29.04	...	30.16	30.61	17	29.76	5	0.85	40.8	+1.8	68.0	10	49.2	13.2	26	34.2	54.8	26.8	5	4.9	30	78.8	34.1	3.06	+2.28	2,978	sw.	30	sw.	11	10	9	14	7
N. Pac. coast region.										45.1	+0.7														6.18	-1.35									
Fort Canby	179	29.84	+.02	30.04	30.45	17	29.57	11	0.88	46.5	+1.5	59.1	4	51.5	33.0	25	42.8	26.1	14.9	12	4.4	9	88.7	43.7	7.25	-0.39	10,583	se.	88	s.	11	16	12	7	11
Neah Bay	...	...	...	...	...	..	...	..	...	...	...	...	..	...	...	..	...	...	...	..	...	..	...	...	...	...	...	...	...	...	..	..	..	..	..
Olympia	36	30.05	-.02	30.01	30.56	17	29.60	11	0.96	43.4	-0.6	61.0	9	48.8	19.8	25	37.8	41.2	23.4	23	4.7	21	88.7	39.9	4.94	-2.10	2,269	s.	24	s.	13	16	14	11	5
Port Angeles	14	...	...	...	...	..	...	..	...	...	...	...	..	...	...	..	...	...	...	..	...	..	...	...	...	...	...	...	...	...	..	..	..	..	..
Pysht	...	...	...	...	...	..	...	..	...	...	...	...	..	...	...	..	...	...	...	..	...	..	...	...	...	...	...	...	...	...	..	..	..	..	..
Tatoosh Island	86	29.94	+.05	30.04	30.52	17	29.43	11	1.09	45.9	-0.1	57.7	9	49.8	36.0	27	42.7	21.7	11.3	10	4.6	9	84.6	41.1	10.15	-2.93	11,177	e.	57	se.	9	17	16	9	5
Astoria	...	30.02	...	...	...	..	...	..	...	45.5	...	60.0	9	50.2	30.1	20	42.1	29.9	16.4	23	2.9	2	85.6	41.2	8.11	+1.47	5,006	ne.	30	ne.	21	16	15	9	6
Portland	88	30.01	-.04	30.10	30.47	17	29.71	11	0.76	44.4	+0.4	68.0	1	50.6	25.2	25	38.5	42.8	25.2	1	6.0	28	82.7	39.0	3.43	-3.36	3,279	nw.	28	s.	12	14	11	12	7
Roseburg	523	29.54	-.05	30.10	30.40	17	29.76	11	0.64	45.5	+2.5	69.1	14	54.5	20.0	26	36.4	49.1	31.5	13	7.3	28	82.9	40.1	3.19	-0.80	1,525	w.	24	se.	11	9	10	14	6
Mid. Pac. coast reg.										55.0	+2.4														0.99	-1.88									
Eureka	...	...	...	...	...	..	...	..	...	...	...	...	..	...	...	..	...	...	...	..	...	..	...	...	...	...	...	...	...	...	..	..	..	..	..
Red Bluff	332	29.71	-.04	30.05	30.32	27	29.74	21	0.58	55.2	+4.2	80.5	19	66.6	27.3	27	43.1	53.2	36.0	19	3.2	30	46.5	31.8	1.52	-1.98	3,715	n.	36	n.	17	6	6	7	17
Sacramento	64	29.99	-.05	30.04	30.32	27	29.73	21	0.59	54.7	+2.7	75.2	3	67.5	28.0	27	41.6	47.2	35.5	15	10.0	30	62.8	41.1	0.45	-1.64	3,190	nw.	27	nw.	25	3	3	3	24
San Francisco	60	30.01	-.04	30.05	30.29	27	29.77	21	0.52	55.2	+0.2	73.7	3	63.2	42.1	26	49.7	31.6	23.5	18	5.0	6	77.6	47.6	0.99	-2.01	4,223	w.	25	nw.	7	5	8	9	13
S. Pac. coast region.										59.6	+1.6														1.44	+0.36									
Fresno	313	29.72	...	30.03	30.29	27	29.71	21	0.58	56.3	...	79.9	3	69.4	31.4	26	42.0	48.5	36.9	16	12.7	30	64.8	43.5	0.32	...	2,266	nw.	24	se.	28	3	0	7	23
Los Angeles	371	29.66	-.03	30.00	30.23	27	29.76	20	0.47	60.0	+2.0	86.0	10	71.8	38.8	30	48.5	57.2	37.1	14	8.4	24	78.1	52.3	0.80	-0.64	3,669	w.	18	w.	19	3	3	9	18
San Diego	67	29.96	-.01	30.00	30.18	27	29.73	22	0.45	59.2	+1.2	82.0	10	66.4	44.4	28	51.5	37.6	29.2	10	6.4	25	76.8	51.1	2.08	+1.35	3,296	nw.	18	nw.	25	4	7	8	15

NOTE.—The following changes in elevation of barometers at the various stations have been made: Boston, Mass., from 124 to 125 feet; New York City, from 168 to 185 feet; Titusville, Fla., from 25 to 12 feet; Raleigh, N. C., from 439 to 375 feet; Montgomery, Ala., from 219 to 217 feet. The data at stations having no departures are not used in computing the district averages.

*106.7. †103.7. ‡104.0. §100.4. ‖106.4.

Meteorological record of voluntary observers and Army post surgeons, November, 1887.

The maximum and minimum temperatures at stations marked thus (*) are from readings of other than standard instruments.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation.
Alabama.	°	°	°	*Inches*
Greensborough	80	20	.....	0.35
Mt. Vernon B'ks...	83	23	58.8	1.18
Arizona.				
Huachuca, Fort....	80	25	54.2	1.16
McDowell, Fort....	90	31	60.3	1.55
Mojave, Fort.....	90	24	63.0	0.14
Tucson	.....	.....	.....	0.74
Arkansas.				
Hot Springs.....	82	19	51.6	4.58
Lead Hill	90	11	46.6	3.64
British Columbia.				
New Westminster .	59	26	42.6	9.02
California.				
Alcatraz Island	73	44	54.3	0.80
Angel Island	80	41	60.4	0.17
Benicia Barracks ..	71	34	55.4	0.38
Bidwell, Fort	68	5	44.1	0.30
Fall Brook.....	87	42	56.0	2.03
Gaston, Fort	72	18	46.8	3.80
Georgetown.....	80	31	52.6	1.44
Hydesville	.....	.....	.....	1.96
Mason, Fort	68	43	56.8	1.04
Nicolaus *	79	26	54.3	1.00
Oakland	68	32	53.4	0.78
Oroville	80	31	56.0	1.21
Presidio of San F ..	77	34	54.3	0.40
Riverside	85	33	57.9	0.92
Sacramento	71	18	47.8	0.54
Salinas	78	28	51.9	0.93
Santa Barbara.....	82	40	58.9	1.10
Willows	78	23	53.0	1.23
Colorado.				
Grand Junction*...	70	4	38.2	1.09
Lewis, Fort.....	65	—21	36.2	1.74
Connecticut.				
Hartford	68	6	37.5	2.80
North Colebrook*..	60	8	30.0	3.56
Southington	65	13	36.5	2.03
Voluntown*.....	71	14	40.3	2.30
Dakota.				
A. Lincoln, Fort ...	75	—24	31.2	0.75
Garden City.....	68	—28	29.4	0.34
Meade, Fort.....	72	—25	33.6	0.24
Parkston	82	—27	38.8	0.43
Pembina, Fort	68	—29	19.9	0.33
Randall, Fort	70	—41	34.0	0.74
Richardton	70	—30	27.5	0.60
Sisseton, Fort	73	—24	27.6	0.19
Sully, Fort	79	—25	33.2	0.02
Totten, Fort	67	—20	34.2	0.17
Webster	77	—27	30.7	0.29
Yates, Fort	76	—24	31.0	0.19
District of Columbia.				
Distribut'g res'v'r*	68	23	43.2	2.23
Receiving res'v'r*..	68	23	44.4	2.07
Rock Creek Bridge*	73	23	47.2	.....
Florida.				
Alva*	87	37	62.8	1.90
Archer*.....	88	24	61.7	0.37
Duke	80	28	61.4	1.21
Fort Meade*.....	85	34	55.0	1.96
Homeland*.....	84	33	64.9	1.75
Limona*.....	85	32	66.7	1.35
Manatee	88	36	66.4	1.61
Merritt's Island ...	81	37	67.4	1.90
Fort St. Augustine.	78	27	61.6	0.40
Tallahassee.....	79	26	60.0	1.45
Georgia.				
Athens.....	74	16	49.5	0.41
Forsyth*	79	22	56.7	1.01
Milledgeville*.....	70	21	52.2	1.13
Quitman	77	26	58.0	1.95
Idaho.				
Boisé Barracks	73	4	40.0	0.04
Lewiston	81	18	.....	1.08
Sherman, Fort.....	56	4	37.0	1.87
Illinois.				
Charleston *	78	0	39.1	7.06
Jacksonville	76	5	40.1	1.76
Monmouth.....	70	— 2	35.6	1.30
Rockford	69	— 4	33.9	1.39
Sandwich*	70	— 2	37.2	2.35
South Evanston....	68	— 2	.....	2.07
Indiana.				
Butlerville*.....	77	1	41.6	3.78
Jeffersonville.....	72	8	43.4	2.87
Laconia.....	78	0	41.8	3.15
Logansport*.....	72	6	39.4	3.81
Maxzy	69	— 5	34.4	3.81
Sunman*	72	0	40.4	3.61
Vevay.....	76	5	42.7	3.05

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation.
Indian Territory.	°	°	°	*Inches*
Gibson, Fort	82	7	48.0	1.27
Reno, Fort.....	83	1	47.2	0.02
Supply, Fort.....	84	— 1	43.0	0.30
Iowa.				
Albia.....	69	—10	38.2	1.55
Bancroft	72	—24	37.4	0.24
Cedar Rapids a ..	70	—14	34.2	0.79
Cedar Rapids b ..	72	—26	33.0	0.48
Clinton	70	— 3	34.3	1.71
Cresco	67	—25	29.4	1.03
Des Moines	75	—15	37.3	T
Fort Madison	68	4	.....	0.93
Humboldt	78	—23	.....	1.05
Independence *	63	—16	32.7	0.83
Logan *	73	—16	37.5	1.50
Monticello*.....	70	—19	32.5	0.77
Mount Vernon*...	70	—12	35.3	0.80
Muscatine	70	— 1	36.4	0.98
Oskaloosa c	.....	.....	.....	1.06
Oskaloosa b*.....	70	—10	35.3	1.38
Webster City	70	15	35.0	0.91
Kansas.				
Elk Falls	.....	.....	.....	0.85
Emporia	78	— 6	43.9	0.84
Globe *.....	76	— 7	41.4	1.10
Hays, Fort.....	84	—16	35.6	3.35
Lebo	87	— 3	42.0	1.13
Manhattan	82	— 9	43.1	0.40
Morse*.....	78	— 8	43.0	.....
Ninnescah	84	— 9	39.9	0.20
Riley, Fort	78	— 8	43.5	0.30
Salina *	62	11	44.5	0.10
Wakefield*.....	80	— 8	42.2	0.70
Wellington	80	— 3	43.8	0.13
W. Leavenworth*.	80	0	43.8	1.38
Wilson.....	82	—14	40.2	1.60
Yates Centre.....	82	0	39.7	0.39
Kentucky.				
Bowling Green*...	74	17	46.0	2.60
Frankfort.....	75	1	42.9	3.17
Louisiana.				
Grand Coteau	78	30	59.6	1.86
Maine.				
Bar Harbor	60	14	.....	3.85
Cornish	61	6	34.2	4.22
Gardiner	59	8	35.1	3.64
Kent's Hill	56	4	33.1	3.99
Orono.....	60	5	33.9	3.48
Skowhegan	57	4	32.9	3.45
Maryland.				
Cumberland	70	16	39.8	0.82
Fallston	66	22	41.6	2.02
Great Falls *.....	70	22	43.4	1.53
McDonogh	67	20	42.8	1.11
McHenry, Fort....	66	16	43.6	0.66
New Midway*.....	70	22	42.2	1.19
Woodstock	67	20	41.0	1.18
Massachusetts.				
Amherst a	65	11	36.5	3.35
Blue Hill Obs'ya..	68	10	38.3	2.60
Blue Hill Obs'yb..	66	7	35.2	2.55
Deerfield	64	10	36.2	3.56
Dudley	65	12	38.7	2.44
Fall River	65	10	39.9	2.53
Heath.....	58	14	.....	.....
Milton	67	13	39.2	2.41
New Bedford	63	13	40.7	2.65
Newburyport	69	13	38.6	3.90
North Truro	.....	.....	.....	2.30
Somerset	69	16	41.3	2.37
Taunton	69	14	40.2	2.32
Westborough*....	72	14	41.1	2.70
Williamstown	64	8	36.4	3.77
Michigan.				
Birmingham	62	19	.....	1.85
Brady, Fort.....	56	— 3	29.5	1.62
Harrisville*.....	63	8	34.1	2.07
Hudson	58	7	32.7	3.09
Kalamazoo	64	12	38.0	2.18
Lansing	65	10	36.6	2.06
Marshall*.....	67	18	.....	2.34
Mottville*.....	69	7	.....	2.70
Thornville*.....	70	13	37.2	2.26
Traverse City	62	8	.....	1.92
Minnesota.				
Minneapolis	63	—20	29.5	0.89
Snelling, Fort.....	70	—25	30.4	0.43
Mississippi.				
Biloxi.....	72	30	59.4	4.65
Missouri.				
Conception	74	2	40.3	0.67
Fayette	82	5	43.5	1.76

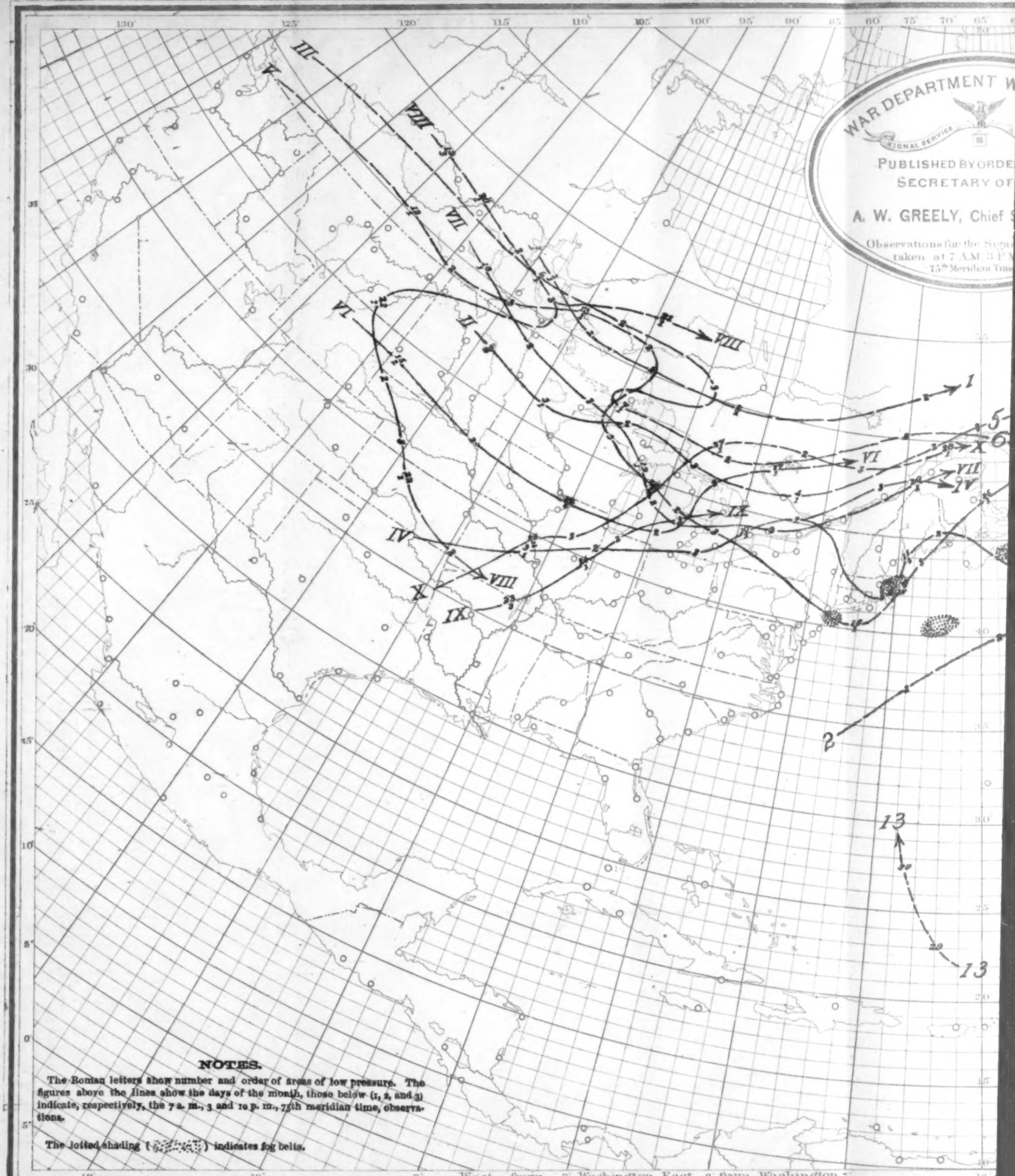
Meteorological record of voluntary observers, etc.—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation.
Montana.	°	°	°	*Inches*
Keogh, Fort	70	—24	31.1	0.16
Missoula, Fort....	54	— 3	31.3	0.58
Shaw, Fort.....	66	—29	34.0	.....
Nebraska.				
Brownville*.....	80	—12	45.2	2.07
De Soto *.....	77	—14	36.4	1.01
Fairbury	.....	.....	.....	0.50
Fremont*.....	76	—16	37.8	.....
Genoa	79	—27	35.3	0.52
Hay Springs.....	.....	.....	.....	0.23
Kimball	87	—21	.....	.....
Lincoln	80	—15	38.6	1.18
Marquette	75	.....	.....	0.61
Niobrara, Fort....	79	—32	34.3	0.32
Robinson, Fort....	77	—19	33.7	0.36
Sidney, Fort	78	—21	35.6	0.15
Tecumseh *.....	75	—14	39.3	0.05
Nevada.				
Carson City	70	4	40.2	T.
McDermit, Fort...	76	5	39.4	0.68
New Hampshire.				
Antrim	.....	.....	.....	3.88
Ashland	.....	.....	.....	4.17
Belmont	.....	.....	.....	3.41
Berlin Mills	69	19	.....	3.52
Bristol.....	.....	.....	.....	3.99
Lake Village.....	.....	.....	.....	3.48
Nashua	66	7	37.1	3.31
Wier's Bridge	.....	.....	.....	3.64
Wolfeborough	.....	.....	.....	4.22
Woodstock	.....	.....	.....	3.31
New Jersey.				
Beverly	70	22	41.4	1.66
Clayton*.....	70	22	41.0	2.02
Dover	66	18	38.2	1.58
Egg Harbor City ..	71	19	41.4	2.60
Moorestown	68	22	41.3	1.68
Readington *.....	70	24	44.5	.....
Salem.....	.....	.....	.....	1.20
Vineland.....	65	43	43.3	2.03
New Mexico.				
Bayard, Fort.....	80	19	52.5	0.00
Gallinas Spring...	70	24	.....	0.45
Las Vegas.....	77	10	.....	1.88
Selden, Fort	82	21	49.8	0.00
Union, Fort.....	70	20	44.1	0.40
Wingate, Fort	63	10	40.3	1.04
New York.				
Ardenia	63	19	33.0	2.81
Auburn	67	9	39.7	2.13
Boyd's Corners ...	65	15	.....	2.69
Brooklyn	67	24	45.5	1 69
Columbus, Fort...	65	12	42.8	1.96
Cooperstown*.....	65	4	34.5	3.15
Factoryville	66	12	36.3	2.17
Friendship.....	68	16	37.1	1.00
Humphrey	62	7	36.0	2.29
Ithaca.....	68	5	37.6	2.01
Le Roy.....	69	14	36.7	2.03
Madison Barracks	68	— 3	36.3	1.46
Menands	62	10	38.3	3.90
Niagara, Fort	68	14	38.9	0.54
Palermo *.....	67	0	33.1	3.25
Plattsburg B'ks...	62	5	33.7	3.14
Palmyra	70	16	39.0	.....
Penn Yan	.....	.....	.....	0.97
Saratoga Springs..	60	17	.....	3.99
Setauket	65	24	42.9	2.62
Syracuse	70	0	.....	.....
Utica	69	7	34.3	1.70
West Point	63	15	40.5	2.86
White Plains	63	17	45.4	3.16
Worcester	63	10	33.6	1.05
North Carolina.				
Chapel Hill	76	23	48.0	0.85
Hot Springs.....	72	12	47.8	.....
Lenoir*.....	67	16	.....	0.70
Lincolnton.....	64	20	43.2	0.12
Statesville*.....	70	20	46.6	0.90
Weldon*.....	73	23	45.3	1.37
Ohio.				
Cleveland	67	6	40.3	3.18
College Hill*.....	60	— 2	45.1	4.00
Elyria	68	0	48.3	3.16
Garrettsville	57	— 5	36.4	2.41
Jacksonborough*.	72	— 1	40.0	4.05
New Athens.....	68	8	.....	.....
Napoleon	66	11	39.3	3.14
North Lewisburg .	68	1	40.9	3.25
Portsmouth	75	6	42.5	2.47
Ruggles*.....	64	— 4	38.7	2.50
Tiffin*	67	4	37.8	3.22
Wauseon	68	8	37.1	3.78
Westerville.....	68	— 8	37.8	3.00
West Milton*.....	70	0	42.1	7.50

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation.
Ohio—Cont'd.	°	°	°	*Inches*
Yellow Springs....	69	— 2	39.3	3.45
Oregon.				
Albany	64	23	43.6	5.92
Bandon *.....	63	28	47.6	6.57
East Portland*....	58	22	.....	4.08
Eola *.....	59	22	43.2	3.10
La Grande	66	1	38.9	.....
Klamath, Fort....	70	2	34.9	1.50
Yaquina L. H.....	69	32	45.9	6.06
Pennsylvania.				
Altoona	69	18	44.9	1.07
Bethlehem *.....	68	19	40.0	1.32
Blooming Grove*.	66	14	37.4	2.40
Catawissa	71	16	.....	1.66
Corry *.....	66	13	36.7	2.99
Drifton.....	68	6	36.6	2.10
Dyberry	65	8	35.0	2.60
Easton	.....	.....	.....	1.55
Franklin *.....	68	10	35.7	2.44
Germantown	68	21	.....	1.45
Grampian Hills...	70	12	35.8	2.25
Indiana	66	17	.....	.....
Meadville	.....	.....	.....	2.50
Phillipsburg	64	10	32.7	1.36
Quakertown	67	18	38.7	1.56
State College.....	70	8	38.4	1.44
Wellsborough *...	71	1	37.2	2.09
West Chester	66	20	41.1	2.13
Westtown	66	18	40.5	1.36
South Carolina.				
Aiken.....	77	23	53.6	0.80
Kirkwood	64	23	45.0	0.55
Cedar Springs.....	76	14	53.3	0.19
Stateburg *.....	76	24	52.0	0.93
Tennessee.				
Ashwood.....	73	13	43.0	1.51
Austin	76	14	47.1	1.50
Milan	77	11	46.0	3.09
Texas.				
Austin*.....	79	33	56.4	1.78
Cedar Hills	.....	.....	.....	5.00
Cleburne *.....	80	14	49.3	2.03
Concho, Fort.....	83	19	52.8	0.68
Corsicana	.....	.....	.....	5.62
Decatur	81	16	52.3	1.69
McIntosh, Fort ...	81	37	62.1	3.12
Mesquite	84	16	51.2	2.65
Midland *	74	16	49.4	0.38
New Ulm	83	26	59.8	0.48
Ringgold, Fort....	83	38	65.1	1.88
Silver Falls	.....	.....	.....	0.31
Vermont.				
Burlington.....	62	7	35.4	4.67
Lunenburg	68	0	32.5	2.15
Manchester	63	4	35.2	5.65
Newport *.....	60	4	33.2	1.10
Strafford *.....	58	— 2	32.8	3.70
Virginia.				
Bird's Nest *.....	73	29	47.8	1.80
Christianburg.....	69	16	.....	0.95
Dale Enterprise*..	73	18	47.4	0.65
Marion	69	10	39.7	0.79
Monroe, Fort	66	30	48.4	2.40
Rappahannock ...	86	19	44.8	1.27
Summit*.....	70	16	42.4	.....
University of Va..	65	32	48.5	1.00
Variety Mills	71	17	42.2	1.02
Wytheville	68	13	43.7	0.49
Washington Territory				
Blakely *.....	62	24	43.0	5.01
Kennewick*	64	8	.....	1.36
Spokane, Fort	57	5	33.9	0.64
Tacoma*.....	63	22	42.3	4.00
Townsend, Fort ..	59	27	44.8	2.00
Vashon	63	24	44.0	3.20
Walla Walla, Fort	67	19	39.6	1.02
West Virginia.				
Clarksburg*.....	69	12	41.0	0.66
Helvetia *.....	71	18	40.7	1.24
Middlebrook*.....	64	9	36.9	.....
Wisconsin.				
Beloit	64	— 5	32.8	1.45
Delavan	65	— 6	31.8	1.21
Embarras*.....	67	—15	32.9	1.35
Fond du Lac	65	—14	31.6	1.27
Franklin	46	—11	.....	0.85
Lancaster	70	—22	32.0	0.08
Madison	64	—14	34.2	1.16
Manitowoc	69	—10	35.5	1.17
Prairie du Chien..	70	—14	34.0	1.30
Wyoming.				
Camp Sheridan ...	68	—19	31.0	0.00
Laramie, Fort	72	—27	35.3	0.05
McKinney, Fort ...	68	—11	36.2	0.07
Washakie, Fort...	66	—26	34.3	0.10

Form 106 C 1884.

Chart I. Tracks of Areas of Low



eas of Low Pressure. November, 1887.

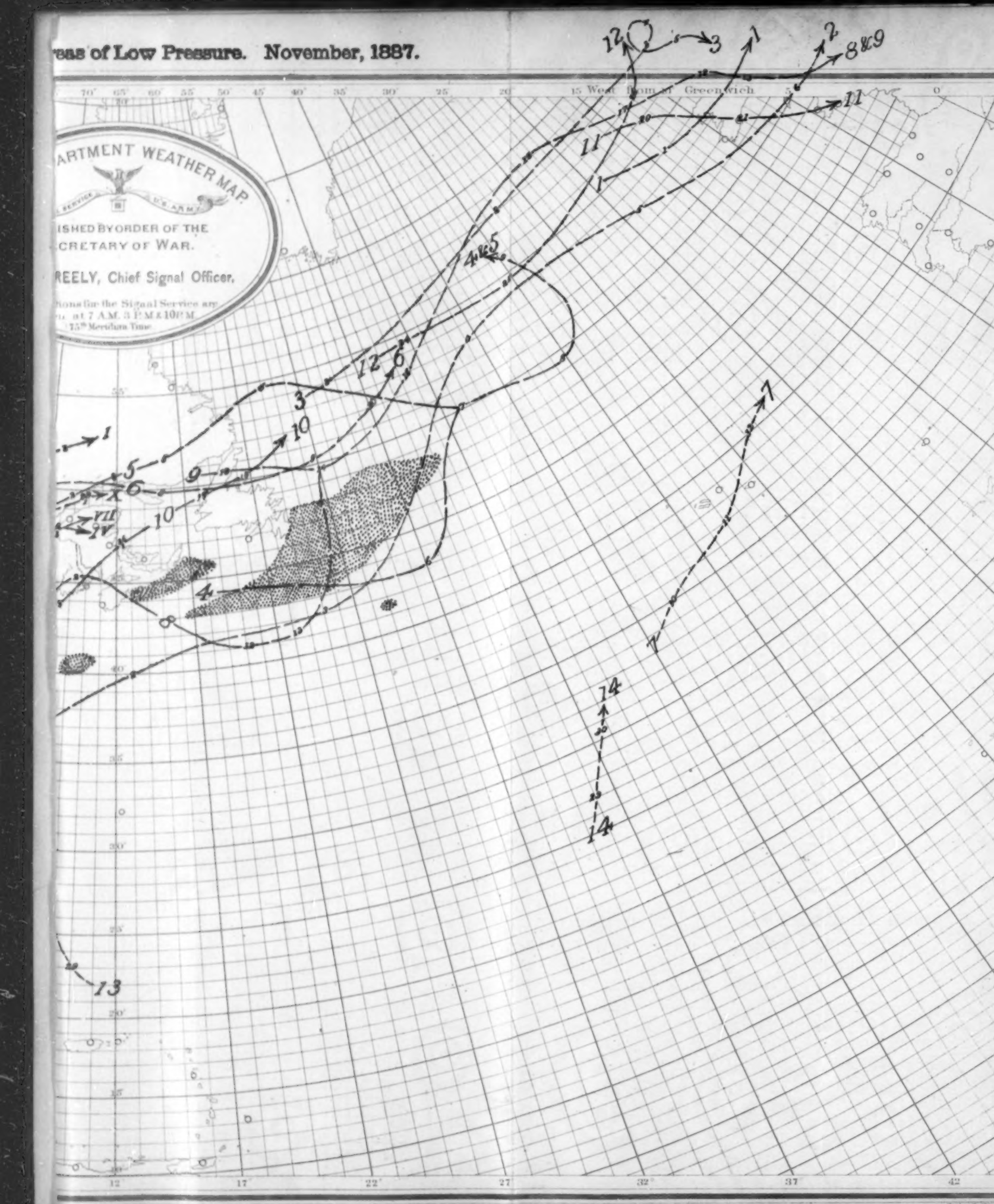
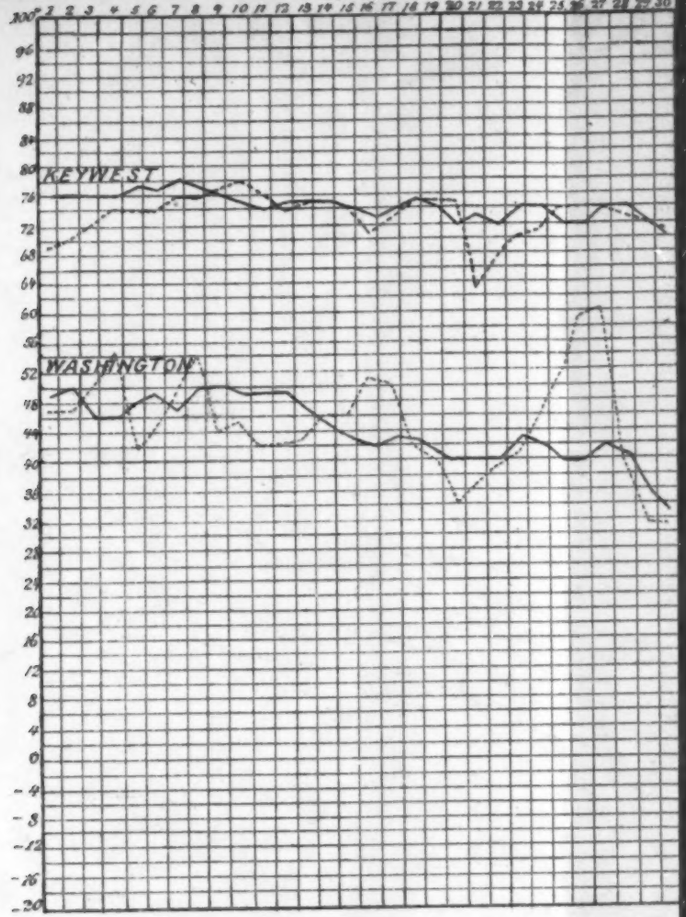
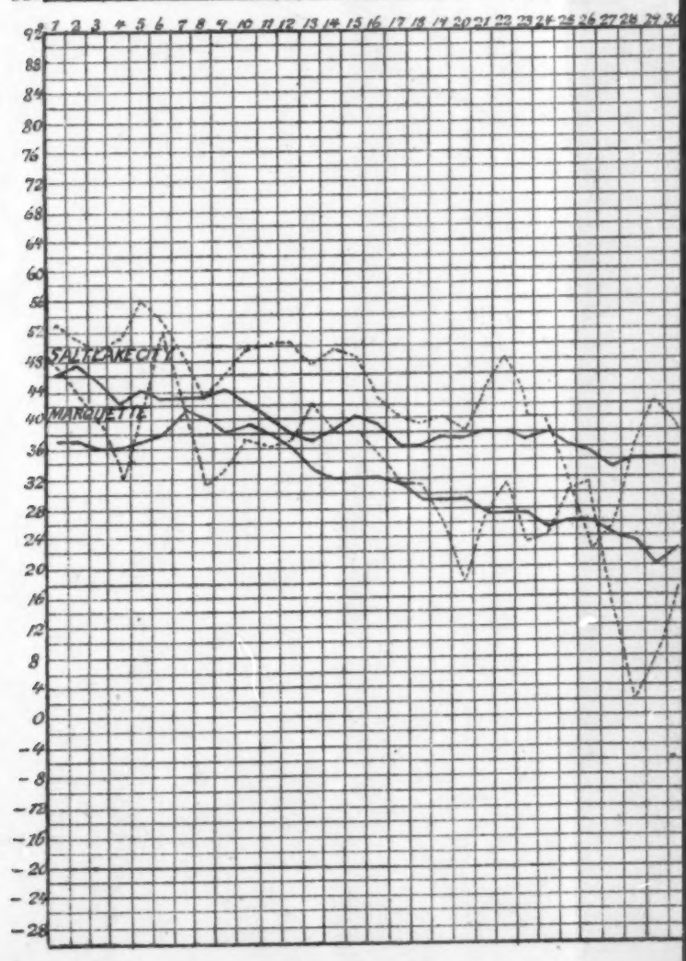
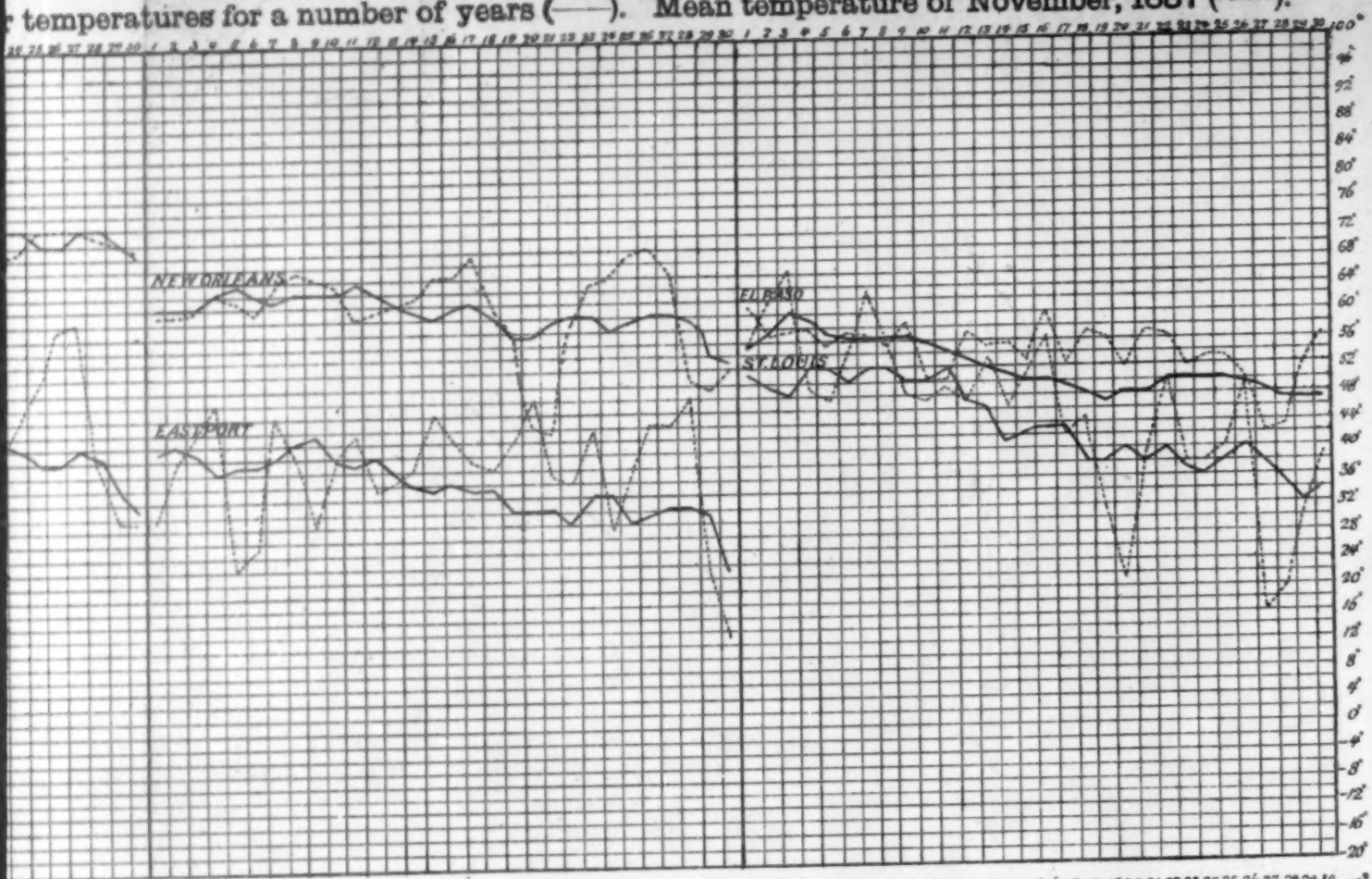


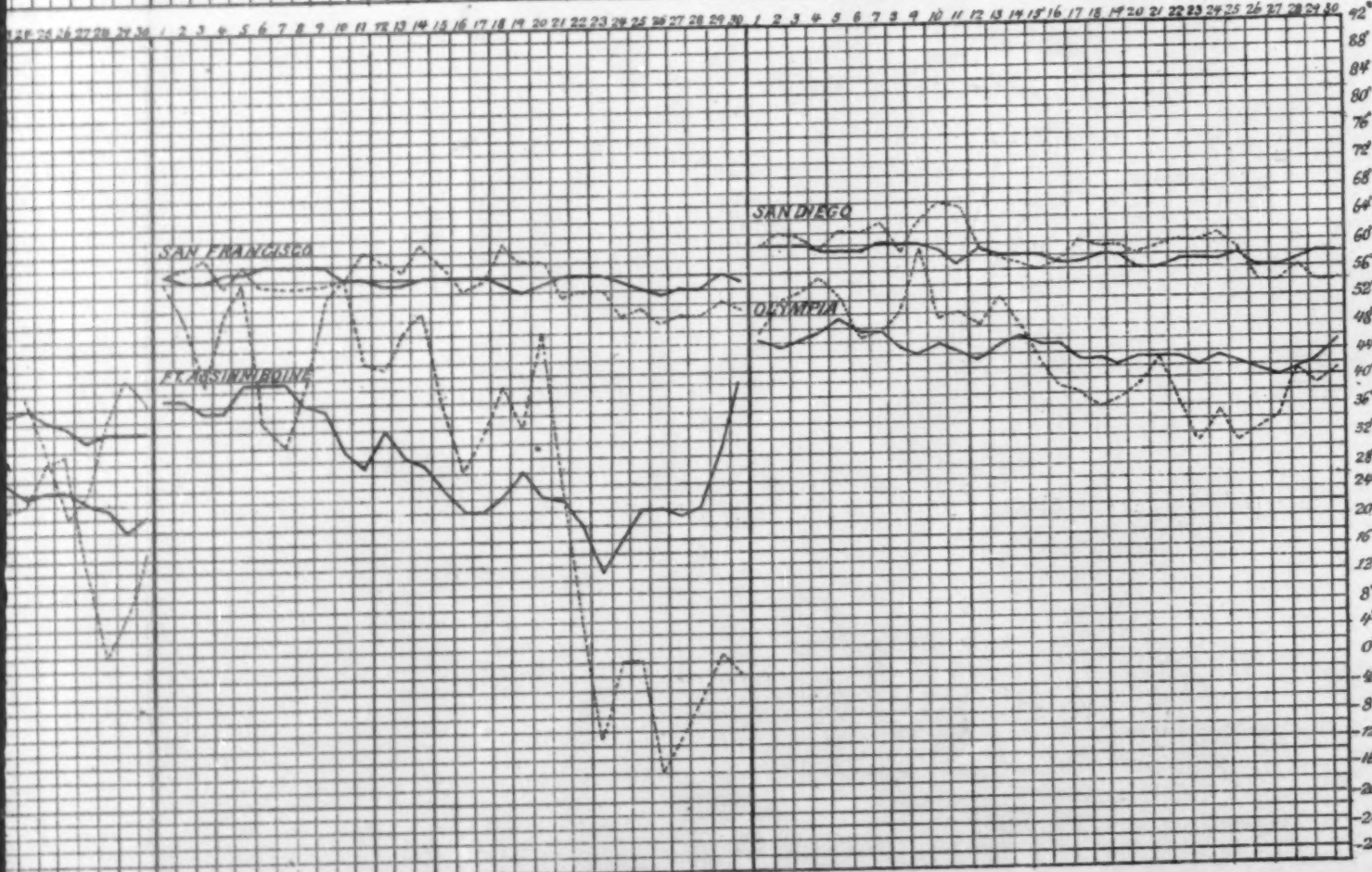
Chart III. Normal November tempera





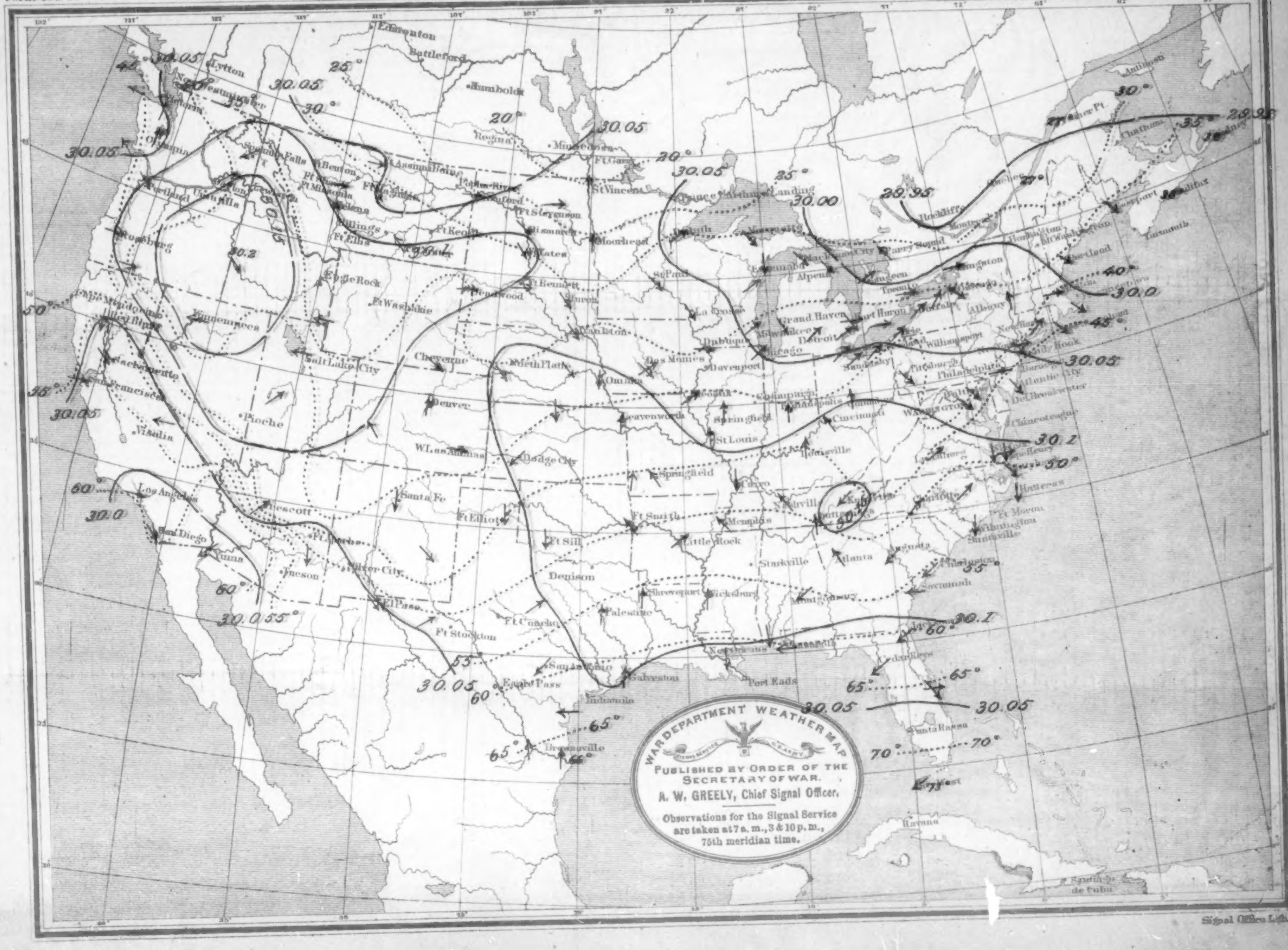
temperatures for a number of years (——). Mean temperature of November, 1887 (----).





Form 106 F.

Chart II. Isobars, Isotherms, and Winds. November, 1887.



Form 106 F

Chart IV. Precipitation, November, 1887.

Signal Office Lith.

Voluntary observers of the Signal Service, on land, from whom meteorological reports were received in time to be used in the preparation of the Monthly Weather Review for November, 1887.

Observer and place of observation.

Alexander, S., Birmingham, Mich.
Acosta, L. P., "Director," Mazatlan, Mex.
Anderson, Dr. W. W., Stateburg, S. C.
Altaffer, J. M., Independence, Kans.
Abbott, Dr. E. K., Salinas, Cal.
Arents, Hiram, Oroville, Cal.
Adams, A. H., Fort Meade, Fla.
Adams, Dr. O. H., Vineland, N. J.
Andrews, Luman, Southington, Conn.
Arden, Richard B., Garrison's, N. Y.
Avey, O. H., Oskaloosa, Iowa.
Boynton, J. F., Syracuse, N. Y.
Beans, Thos. J. Moorestown, N. J.
Bell, Joseph, Franklin, Pa.
Boerner, Prof. Chas. G., Vevay, Ind.
Bently, David, Willows, Cal.
Bayerly, J. F., Spartanburg, S. C.
Ballou, Dr. N. E., Sandwich, Ill.
Bennett, Geo., Bandon, Oregon.
Boies, Lt. A. H., Hudson, Mich.
Baker, Dr. Henry B., Lansing, Mich.
Beall, Dr. R. L., Lenoir, N. C.
Bartlett, E. B., Vermillion, N. Y.
Briggs, John. Albany, Oregon.
Betts, Prof. Arthur, Webster, Dak.
Breed, J. E., Embarras, Wis.
Beloit College, Observatory, Beloit, Wis.
Birt, Thomas, Utica, N. Y.
Broberg, Mrs. Mary W., Manatee, Fla.
Black, W. H., Kalamazoo, Mich.
Blachly, C. P., Manhattan, Kans.
Bridges, Q. A., Berlin Mills, N. H.
Bowman, Peter, Ruggles, Ohio.
Bush, John W., Worcester, N. Y.
Boyd, Joseph, Oskaloosa, Iowa.
Blockman, L. E., Santa Maria, Cal.
Barton, Wm. G., Kimball, Nebr.
Chatfield, F. W., Las Vegas, N. Mex.
Cook, S. A., Milledgeville, Ga.
Carrington, G. D., Brownville, Nebr.
Calhoun, P. B., Austin, Tenn.
Carpenter, Dr. W. B., Leavenworth, K.
Charbonnier, Prof. L. H., Athens, Ga.
Chapin, Adams, Poway, Cal.
Casey, Geo., Auburn, N. Y.
Cornell University, Ithaca, N. Y.
Collin, Prof. Alonzo, Mount Vernon, Iowa.
Cutting, Dr. Hiram A., Lunenburg, Vt.
Clark, F. A., Weldon, N. C.
Cutler, B. B., Heath, Mass.
Collie, G. L., Delavan, Wis.
Conant Observatory, Dudley, Mass.
Cotton, Dr. D. B., Portsmouth, Ohio.
Cheney, Wm., Minneapolis, Minn.
College of Sacred Heart, Prairie du Chien, Wis.
Carter, Rev. Dr. W. H., Tallahassee, Fla.
Cummings, L. D., Palmyra, N. Y.
Crump, M. H., Bowling Green, Ky.
Crozier, Lafe, Laconia, Ind.
Cochran, Wm. P. Wakefield, Kans.
Caulkins, John S., Thornville, Mich.
Chandler, Dr. W. J., South Orange, N. J.
Case, W. Earle, Roseland, N. J.
Curtiss, G. G., Fallston, Md.
Comstock, Prof. F. M., LeRoy, N. Y.
Craig, W. F., Marion, N. C.
Cutler, J. L., Quitman, Ga.
Carpenter, Ford A., Vashon, Wash.
Colson, jr., J. M., Petersburg, Va.
Dollenmayer, E. Y., Wilson, Kans.
Dingmore, Prof. F. H., Emporia, Kans.

Observer and place of observation.

Donald, H. D., Decatur, Tex.
Drake, W. T., Marshall, Mich.
Dudley, Chas. B., Altoona, Pa.
Dunlap, W. L., Tecumseh, Nebr.
Dazey, J. B., Charleston, Ill.
Deming, H. D., Wellsborough, Pa.
Davis, McLean W., Indiana, Pa.
Dewhurst, Rev. E., Voluntown, Conn.
Day, Theodore, Dyberry, Pa.
Ellsworth, W. W. Hartford, Conn.
Edgington, R. P., Morse, Kans.
Eliason, W. A., Statesville, N. C.
Ellis, John, Marquette, Nebr.
Ewell, Dr. M. D., South Evanston, Ill.
Evans, J. W., Aims, Colo.
Eckstein, Rev. M., Conception, Mo.
Foss, E. T., Hydeville, Cal.
Ferris, B. F., Sunman, Ind.
Fouch, Dr. A., Andersonville, Cal.
Friend, Chas. W., Carson City, Nev.
Ferrill, B. P., Duke, Fla.
Frear, Wm., State College, Pa.
Fernald, Prof. M. C., Orono, Me.
Fleming, John, Readington, N. J.
Fuller, Edw. N., Tacoma, Wash.
Featherston, Wm., Globe, Kans.
Fox, F. E., Fall Brook, Cal.
Fitzgerald, C. M., Georgetown, Cal.
Gibson, J. H., Salina, Kans.
Gates, W. B., Burlington, Vt.
Gray, F. R., Yates Centre, Kans.
Goodspeed, Chas. W., Elyria, Ohio.
Gowey, H. D., North Lewisburg, Ohio.
Green, Dr. Jesse C., West Chester, Pa.
Gerrish, S. H., Sacramento, Cal.
Goodwin, Rev. William, North Colebrook, Conn.
Gibbs, Geo. I., Grand Turk, Turk's Island, British W. Indies.
Gray, Capt. A. W., Kenowick, Wash.
Grathwohl, John, Blooming Grove, Pa.
Gore, Prof. J W., Chapel Hill, N. C.
Geddings, Dr. W. H., Aiken, S. C.
Hewit, S. F. H., Middlebrook, W. Va.
Hodge, Rev. F. B., Wilkesbarre, Pa.
Holt, A. K., Riverside, Cal.
Humphrey, Dr. J., Fairbury, Nebr.
Hamilton, W. H., Corsicana, Tex.
Harvard College Observatory, Cambridge, Mass.
Hammitt, John W., College Hill, Ohio.
Harris, T. C., Raleigh, N. C.
Heaton, Isaac E., Fremont, Nebr.
Hoskinson, R. M., Blakely, Wash.
Hardy, Samuel E., East Norway, Kans.
Hyde, G. A., Cleveland, Ohio.
Hartzler. J. A., Mottville, Mich.
Hole, C. F., Butlerville, Ind.
Heatwole, L. J., Dale Enterprise, Va.
Harris, W. C., Dover, N. J.
Hunter, Dr. T. C., Napoleon, Ohio.
Helm, Thos. B., Logansport, Ind.
Heacock, J. L., Quakertown, Pa.
Hazen, Rev. A., Deerfield, Mass.
Hinsdale, Dr. R. G., Biloxi, Miss.
Hasenstab, Philip J., Jacksonville, Ill.
Haywood, Prof. John, Westerville, Ohio
Ireland, W. H., Rappahannock, Va.
Jessup, J. G., Newport, Oregon.
Jones, Dr. E. U., Taunton, Mass.
Jordan, Dr. M. D. L., Milan, Tenn.
Kirkwood, E., Mauzy, Ind.
Knapp, J. G., Limona, Fla.
Keese, G. Pomeroy, Cooperstown, N. Y.

Observer and place of observation.

Koontz, Alph, Albia, Iowa.
Lincoln, A. T., Marion, Va.
Loveland, Wm. Corry, Pa.
Loomis, J. C., Jeffersonville, Ind.
Logan, David, Meadville, Pa.
Luther, S. M., Garrettsville, Ohio.
Lerch & Rice, Bethlehem, Pa.
Lüps, Miss Clasina, Manitowoc, Wis.
Loundes, R. T., Clarksburg, W. Va.
Lackey, Silas G., Mesquite, Tex.
Lee, Elon, Webster City, Iowa.
Moore, C. R., Bird's Nest, Va.
Montgomery, J. H., Meadville, Pa.
Miller, H. D., Drifton, Pa.
Manning, Thomas, Carmel, N. Y.
Morgan, L. Ray, Phillipsbury, Pa.
McDonogh Institute, McDonogh, Md.
McClintock, Frank, Grand Junc'n, Colo.
Marshall, Gregory, Cresco, Iowa.
Massachusetts Agricultural Experimental Station, Amherst, Mass.
McCready, Miss L. A., Ft. Madison, Iowa
McGahan, Dr. C. F., Hot Springs, N. C.
Mikesell, Thos., Wauseon, Ohio.
Micklem, J. H., Variety Mills, Va.
Macrae, Colin, Kirkwood, S. C.
Meehan, Thomas, Germantown, Pa.
Moore, Dr. J. W., Easton, Pa.
Motte, Luke S., West Milton, Ohio.
Moore, Nathan, Grampian Hills, Pa.
Mitchell, Dr. D. W., Harrisville, Mich.
Newcomb, G. S., Westborough, Mass.
Nordberg, Prof. A., Richardton, Dak.
Newell, Dr. W. C. T., Garden City, Dak.
Neal, Dr. J. C., Archer, Fla.
Ogden, Charles, Elkin, Ky.
Osborn, Dr. T. C., Cleburne, Tex.
Olds, H. D., Cedar Rapids, Iowa.
Pearce, Thomas, Eola, Oregon.
Prouty, Florence, Humboldt, Iowa.
Peele, Capt. Adolphus, New Westminster, B. C.
Palmer, Frank W., Antrim, N. H.
Peckham, Prof. W. C., Brooklyn, N. Y.
Pollock, Edw., Lancaster, Wis.
Postma, H. Y., Egg Harbor City, N. J.
Pendleton, A., Nicolaus, Cal.
Pike, F. V., Newburyport, Mass.
Romig, J. K., La Grande, Oregon.
Rathburn, J. C., Midland, Tex.
Remington, C. V. S., Fall River, Mass.
Roberts, Luke, Clinton, Iowa.
Runge, C., New Ulm, Tex.
Richardson, C. F., Beverly, N. J.
Rotch, A. L., Blue Hill Observatory, Blue Hill, Mass.
Rodman, Thomas R., New Bedford, Mass
Rice, Chas. W., Yellow Springs, Ohio.
Richmond, S. L., Salem, N. Y.
Rodgers, Jesse D., Nile, N. Y.
Sewell, T. M., New Athens, Ohio.
Strong, W. C., Kent's Hill, Me.
Stern, Jacob T., Logan, Iowa.
Smith, H. D., Monticello, Iowa.
Shaw, E., Ninnescah, Kans.
Seltz, Chas., De Soto, Nebr.
Shriver, E. T., Cumberland, Md.
Smith, Prof. T. Berry, Fayette, Mo.
Schleicher, Rob't Lewiston, Idaho.
Shriver, Howard, Wytheville, Va.
Scott, Thos. G., Forsyth, Ga.
Stucky, Dr. C. T., Helvetia, W. Va.
Slade, Elisha, Somerset, Mass.

Observer and place of observation.

Starr, Prof. Fred'k, Cedar Rapids, Iowa.
Silvius, U. O., Franklin, Wis.
Sonedecker, Rev. T. H., Tiffin, Ohio.
Smith, John R., North Truro, Mass.
Sim, J. R., Summit, Va.
Scribner, H. F. J., Strafford, Vt.
Strong, S. B., Setauket, N. Y.
Swartz, John J., Parkston, Dak.
Samoetz, Oscar, Austin, Tex.
Smith, George F., New Midway, Md.
Standenmayer, Dr. L. R., Lincolnton, N. C
Trembly, Dr. J. B., Oakland, Cal.
Tilford, C. M., Silver Falls, Tex.
Tillinghast, C. B., Albany, N. Y.
Teele, Rev. A. K., Blue Hill, Mass.
Truman, Geo. S., Genoa, Nebr.
Turnbo, Silas C., Pro Tem, Mo.
Tuohy, John, Lewis Creek, Cal.
Thomas, Felix, Saratoga Springs, N. Y.
Thrasher, B., Newport, Vt.
University of Nebraska, Lincoln, Nebr.
Vail, Hugh D., Santa Barbara, Cal.
Vermillion, W. W., Frankford, Mo.
Voegeli, Adolphus, Des Moines, Iowa.
Wilson, W. C., Clayton, N. J.
Wickersham, Wm. F., Westtown Pa.
Went, E. C., Frankfort, Ky.
Wedge, J. C., Fond du Lac, Wis.
Wade, J. S., Homeland, Fla.
Washburn Observatory, Madison, Wis.
Wild, Rev. E. P., Manchester, Vt.
Williams, Rev. C. F., Ashwood, Tenn.
West, Silas, Cornish, Me.
Wells, Rev. Charles L., Gardiner, Me.
Wylie, Wm., Mount Forest, Canada.
Wait, S. E., Traverse City, Mich.
Washington Aqueduct. — Receiving Reservoir, D. C; Distributing " "; Great Falls Reservoir, Md; Rock Creek Bridge, D. C.
Woodstock College, Woodstock, Md.
Williams College Observatory, Williamstown, Mass.
Wolfe, John H. Wellington, Kans.
Wülfke, E. F., Independence, Iowa.
Wearmouth, James, University of Virginia, Va.
Winipiseogee Lake Cotton and Woolen Manufacturing Co. — Weir's Bridge, N. H.; Woodstock, N. H.; Wolfeborough, N. H.; Lake Village, N. H.; Bristol, N. H.; Belmont, N. H.; Ashland, N. H.
Willis, O. R., A. M., Ph. D., White Plains, N. Y.
Wood, Joseph, Bar Harbor, Me.
Wigg, Dr. Geo., East Portland, Oregon.
Wright, J. W. A., Livingston, Ala.
Whitney, Chas. E., Humphrey, N. Y.
Whitney, William A., Skowhegan, Me.
Widman, Rev. C. M., Grand Coteau, La.
Williams, Dr. A. C., Elk Falls, Kans.
White, Rev. J. H., Georgiana, Fla.
Wetmore, Edw. L., Tucson, Ariz.
Whitmore, J. E., Gallinas Spring, N. Mex.
Walton, J. P., Muscatine, Iowa.
Waterman, Wm., Hay Springs, Nebr.
Webster, Chas. H., Nashua, N. H.
Yates, T. P., Factoryville, N. Y.
Yetter, Wm. G., Catawissa, Pa.
Young, Geo. R., Penn Yan, N. Y.

Military posts from which meteorological reports were received, through the Surgeon General of the Army, in time to be used in the preparation of the Monthly Weather Review for November, 1887.

Alcatraz Island, Cal.
Angel Island, Cal.
A. Lincoln, Fort, Dak.
Bayard, Fort, N. Mex.
Benicia Barracks, Cal.
Bidwell, Fort, Cal.
Brady, Fort, Mich.
Boisé Barracks, Idaho.
Concho, Fort, Tex.
Columbus, Fort, N. Y. H.
Camp Sheridan, Wyo.
Gaston, Fort, Cal.
Gibson, Fort, Ind. T.
Hays, Fort, Kans.
Hot Springs, Ark.
Huachuca, Fort, Ariz.
Klamath, Fort, Oreg.
Keogh, Fort, Mont.
Lewis, Fort, Colo.
Laramie, Fort, Wyo.
Meade, Fort, Dak.
McIntosh, Fort, Tex.
Missoula, Fort, Mont.
Mason, Fort, Cal.
McDermit, Fort, Nev.
McDowell, Fort, Ariz.
Monroe, Fort, Va.
Mojave, Fort, Ariz.
Madison Barracks, N. Y.
McHenry, Fort, Md.
Mount Vernon B'ks, Ala.
McKinney, Fort, Wyo.
Niagara, Fort, N. Y.
Niobrara, Fort, Nebr.
Pembina, Fort, Dak.
Presidio of San F., Cal.
Plattsburg Barracks, N. Y.
Robinson, Fort, Nebr.
Reno, Fort, Ind. T.
Randall, Fort, Dak.
Ringgold, Fort, Tex.
Riley, Fort, Kans.
Snelling, Fort, Minn.
St. Francis B'ks, St. Augustine, Fla.
Sisseton, Fort, Dak.
Shaw, Fort, Mont.
Sherman, Fort, Idaho.
Selden, Fort, Nebr.
Supply, Fort, Ind. T.
Sully, Fort, Dak.
Spokane Fort, Wash.
Sidney, Fort, Nebr.
Totten, Fort, Dak.
Townsend, Ft., Wash.
Union, Fort, N. Mex.
Washakie, Fort, Wyo.
West Point Military Academy, N. Y.
Walla Walla, Ft., Wash.
Wingate, Fort, N. Mex.
Yates, Fort, Dak.

State weather services from which meteorological reports were received in time to be used in the preparation of the Monthly Weather Review for November, 1887.

Alabama, P. H. Mell, jr., Signal Corps, director, Auburn, Ala.
Illinois, Col. Charles F. Mills, director, Springfield, Ill.
Indiana, Prof. H. A. Huston, director, Lafayette, Ind.
Kansas, Prof. J. T. Lovewell, director, Topeka, Kans.
Louisiana, R. E. Kerkam, Sgt., Signal Corps, director, New Orleans, La.
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Pennsylvania, under direction of Franklin Institute, Philadelphia, Pa.
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